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The Orb Weaver Genus *Mangora* in South America (Araneae, Araneidae)

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THE ORB WEAVER GENUS *MANGORA* IN SOUTH AMERICA (ARANEAE, ARANEIDAE)

HERBERT W. LEVI[1]

ABSTRACT. Of the 18 previously known *Mangora* species from South America, three names are synonyms and 12 species have their genitalia illustrated here for the first time. All of the 127 new species found are described, illustrated, and named. Most of these many species are found in the Amazon drainage. All the species outside the Amazon have only limited distributions except *M. melanocephala*, the most common *Mangora*, found between the Isthmus of Tehuantepec, Mexico, and northern Argentina. Only four species found in Central America extend their ranges to South America. A new method of immobilizing and examining palpi is described.

INTRODUCTION

South American *Mangora* have previously been impossible to determine. Of the few species described, most had unrecognizable descriptions or lacked adequate illustrations. Eighteen species are listed in Platnick's catalog (2006). *Mangora mathani* Simon was erroneously listed as a nomen nudum. *Mangora decolorata* (Keyserling) does not occur in South America, a citation error of Platnick (2006) and older catalogs. Three names are synonyms of older names, leaving 15 species. Of these, 12 never had their genitalia illustrated, or the illustrations were unrecognizable. Of 142 species considered in this study, 127 are new. Because in the past most species could not readily be determined, little is known about *Mangora*. Ecological and behavioral research have been limited to a few well-described species.

Because there is little overlap with South American species, the 32 species of Mexico and Central America were revised separately in a previous publication (Levi, 2005). An earlier paper treated the seven species north of Mexico (Levi, 1975).

Mangora species make a very fine, dense orb web. The common North American *M. gibberosa* (Hentz) makes its fine-meshed web in the tall grass of meadows. The European *M. acalypha* (Walckenaer) is found in sparse vegetation on sandy ground. Webs are vertical or slightly inclined, occasionally almost horizontal. The web of *M. acalypha* can have 50 to 60 radii and only 10 to 12 circles of temporary spiral, with 500 to 600 attachments. The viscid threads of *M. acalypha* are only 1 mm apart, and there can be 50 to 60 in one sector. The spiders work rapidly, the temporary spiral being completed in 7 minutes. The small spiders rest in the hub. There is no retreat. When disturbed, the spider drops on a thread (Wiehle, 1931).

When mating, the male stays attached to the female with an insertion of about 7 seconds; a minute later, there is a second insertion. After three to six or up to 13 insertions, alternating the palpi, the male leaves on a thread but may soon return to start a new series of insertions (Wiehle, 1931).

The outer lobe of the epigynum of many South American *Mangora* is broken off, not observed previously. Presumably this happens when mating and makes further mating with other males more difficult.

Although *Mangora* are mainly diurnal, Lubin (1978) found webs of *M. pia* at night in Panama. There is recent literature by Eberhard (1982) describing radii construction, by Carico (1986) on web remov-

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al patterns, and by Craig (1987a,b, 1988, 1989) on behavior and the structure of silk in the Panamanian and northern South American *M. pia*. However, nothing has been published about the function of the unique feathered trichobothria on the third tibia, or the high carapace: Does it contain a large venom gland, or perhaps stomach or brain tissue?

Of the 142 species here described, only 62 are known from both sexes, 59 from females only, and 21 from males only. It is possible that some of the new males belong to described females.

METHODS

The methods used were the same as in Levi (2005), except for the use of a new embedding medium to immobilize small genitalia for examination and illustrating.

The immobilizing medium is K-Y Jelly (or similar personal lubricant available from pharmacies). K-Y Jelly is miscible in both water and alcohol. One or two drops of the jelly are placed in a dish and the genitalia to be illustrated are directly transferred from alcohol into the bottom of the jelly. The submerged specimen can be placed in the required position and stays as oriented. A thin layer of 80% alcohol may be added over the jelly to reduce reflections. After use, the genitalia are placed in a small dish with hot water to remove the jelly from the specimen. After 10 minutes in hot water, some alcohol is added, and after a short time, the specimen is returned to its vial. (Nadine Dupérré made me aware of the procedure, but it originated with J. Cokendolpher. J. Cokendolpher and N. Dupérré permitted me to publish the method.)

As mentioned in the previous *Mangora* publication (Levi, 2005), eye placement and measurements are rough estimates made by viewing from above and slightly anterior. Sizes and distances of eyes are given in numbers, not to indicate accuracy, but to avoid verbiage. Measurements are made relative to the diameter of eyes.

The position of the posterior eye row is measured in relation to a hypothetical line behind the eyes, as viewed from above. The ocular quadrangle is measured by drawing an imaginary line around the eyes.

Total length was measured without stretching the animal because the abdomen is often at an angle to the prosoma.

The illustrations here of previously described species were made in 1970, when I borrowed the types of all American species of *Mangora* for revising the North American species (Levi, 1975).

In the illustrations, the ventral view of the epigynum is often tilted at an angle, with the anterior end slightly higher. For the posterior view, the epigynum was pulled out with a fine, mounted needle. The posterior view is sometimes from slightly ventral with the anterior end of the spider slightly pulled up. A drop of Hoyer's Medium on the epigynum was used to temporarily clear it. (Some colleagues have used sodium hydroxide for clearing, but this is not clearing oil; it digests the tissues, indirectly making the structure more transparent. However NaOH could warp structures of the epigynum or palpus.)

A spine is here considered an immovable pointed structure, whereas the strong, movable setae on legs are referred to as macrosetae.

The directions for locating structures in the illustrations refer to the numbers on the face of a clock (h). The illustrations of the posterior view of the epigyna have their venter up and dorsum down.

Specimens used came from the following collections and individuals.

AMNH	American Museum of Natural History, New York; W. J. Gertsch, J. A. L. Cooke, N. Platnick, L. Sorkin.
ANSP	Academy of Natural Sciences, Philadelphia; D. Azuma.
BMNH	The Natural History Museum, London, United Kingdom; P. Hillyard, J. Beccaloni.
CAS	California Academy of Science,

San Francisco; C. Griswold, D. Ubick.
CUC Cornell University Collection kept in the AMNH.
FSCA Florida State Collection of Arthropods, Gainesville, Florida; G. B. Edwards.
HGF H. G. Fowler; Universidade de São Paulo, Rio Claro, Est. São Paulo, Brazil.
IBSP Instituto Butantan, Laboratório de Artrópodos Peçonhentos, São Paulo, Brazil; A. D. Brescovit.
ICNB Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogota, Colombia; E. Florez.
INPA Instituto Nacional de Pesquisas da Amazônia, Manaus, Est. Amazonas, Brazil; C. Magalhaes.
MACN Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina; C. L. Scioscia.
MCN Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil; E. H. Buckup.
MCP Museu de Ciências, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil; A. A. Lise.
MCZ Museum of Comparative Zoology, Cambridge, Massachusetts; G. Giribet, L. Leibensperger.
MECN Museo Ecuatoriano de Ciencias Naturales, Quito, Ecuador; Germania Estévez Jácome, Leticia Avilés.
MLP Museo de Universidad Nacional, La Plata, Argentina; C. Ituarte, L. A. Pereira.
MNHN Museum National d'Histoire Naturelle, Paris, France; C. Rollard.
MNRJ Museu Nacional, Rio de Janeiro, Brazil; A. Timotheo da Costa, A. B. Kury.
MUSM Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru; G. Lamas, D. Silva D.
MZSP Museu de Zoologia da Universidade de São Paulo, São Paulo, SP, Brazil; P. Vanzolini, J. L. Leme, R. Pinto da Rocha.
NHMB Naturhistorisches Museum, Basel, Switzerland; E. Sutter, A. Hänggi.
PAN Polish Academy of Science, Warsaw, Poland; J. Proszynski, A. Slojewska, M. Adamczewska, W. Tomaszewska.
SMF Senckenberg Museum, Frankfurt am Main, Germany; M. Grasshoff, P. Jäger.
UBTU Coleção Científica de Aranhas do Departamento de Zoologia, Universidade de São Paulo, Botucatu, Brazil; I. M. P. Rinaldi.
USNM National Museum of Natural History, Washington, D.C.; J. Coddington, F. S. Larcher, D. G. Furth.
ZMUC Zoologisk Museum, Copenhagen, Denmark; H. Enghoff, N. Scharff.

After the revision was complete, I received two large important collections from areas that had been undersampled: Peru and Colombia. Among these collections were some new species and males of several species known previously from females only. The Colombian collection contained the first specimens of *M. fornicata* (Keyserling), known only from the original specimens. These additions explained the broken nature of the epigyna of some species. This new information had to be incorporated into the paper and 45 new illustrations added to the finished plates, rather awkwardly in some cases.

My revisions of araneids were started at a time when museums would freely loan specimens (unlike olden times when types were locked up in museums, available only to rare visitors), and they could easily be returned. Also, collecting in various coun-

tries was permitted without bureaucratic permits. At present, some countries do not permit export of specimens, others only with permits. Times have changed in such a way that future revisions will be cumbersome and extremely costly.

DISCUSSION

Judging by previous revisions of araneid genera in which one-third of the species had been described, I expected 40 to 50 new species. Actually, the numbers found were 127 new with only 15 previously described. Many South American areas have been poorly collected, suggesting that there may be two or three times as many species. A probable reason for the few descriptions is that many species are very small, less than 2.5 mm total length.

Some *Mangora* species around the periphery of the Amazon, the area of greatest abundance, have only small distributions.

Platnick (2006) lists only one species from Europe, the Palearctic *M. acalypha*, one species from Sri Lanka, two from southeast Asia, 10 from eastern Asia (Yin, 1997), and none from Africa. However, related genera *Psyllo* and *Umbonata* are found in Africa and *Prasonicella* in Madagascar, and *Prasonica* has several species in Africa and a few in the Orient and New Guinea (Grasshoff, 1971).

Lack of a good series of specimens for many species makes it difficult to decide whether differences between epigyna are due to normal variation or indicate species-level divergence. This is especially difficult to decide in females from widely separated collecting localities. Male palpi have more characters than female epigyna and are easier to separate. But the short-lived males are less common in collections than females. It is surprising that so many new males were found that could not be matched to females.

Although in many genera the epigyna can be used to match male palpi, this is not true in *Mangora*. Also many *Mangora* species have similar coloration, also making matches difficult. (This also makes it difficult to place illustrations of similar species adjacent.) Exceptions are few: species with nine black spots on the abdomen dorsum (Figs. 418–457) can have a similar median apophysis (Figs. 420, 427, 435, 448, 456).

Keyserling's female syntypes of *M. fornicata* (Figs. 524, 525) differ from his own illustration. One possible explanation is that the edge of the epigynum broke off when handling. The explanation was suggested by Colombian specimens: several species came in a series, with some specimens whole and others with the edge broken off. But had holotypes of new species illustrated here their epigynum broken? (e.g., *M. acre*, Figs. 4, 6; *M. mapia,* Fig. 9; and perhaps others). Was this breakage noticed only because many Colombian species came in a series, whereas other collections had only a few specimens? Or is the breakage limited to species occurring in northwestern South America? No answer was found. Apparently, males in some species tear off the edge of the epigynum after mating (Figs. 436–443, 527–530), thereby preventing later mating with other males.

TAXONOMIC SECTION

Mangora O. P.-Cambridge

Mangora O. P.-Cambridge, 1889: 13. Type species *Mangora picta* O. P.-Cambridge from Guatemala, designated by Simon, 1895; Levi, 1975: 116.

Diagnosis. Mangora is one of the most distinct genera of orb-weavers. It differs from most other genera by having the cephalic region of the carapace always about half the maximum width of the thoracic region (Fig. 25). The thorax is very high, evenly sloping toward the eyes (Figs. 1, 3), and has a longitudinal median line. The abdomen is always longer than wide (Figs. 19, 20). All *Mangora* species differ from all other araneid genera found in America by having a set of long, feathered trichobothria on the anterior face of the third tibia of both males and females (Figs. 2, 3).

Metazygia species have been confused with *Mangora*. *Manogea porracea* (C. L. Koch) is also surprisingly, but only superficially, similar (Levi, 1997, figs. 79–93). Both differ from *Mangora* by having a lower thorax and lacking feathered setae on the third tibia.

Note. Grasshoff (1971) split some species of *Mangora* into several genera on the basis of the number of rows of feathered setae on the third legs. None of these are American.

Description. Virtually all South American *Mangora* preserved in alcohol are yellowish and have few, thin setae. The cephalic region is black (Fig. 140), or eyes have black rings (Fig. 188). Some species have a gray or black band on the side of the carapace (Figs. 114, 140). The sternum often has a darker rim; sometimes the sternum is black (Fig. 228). The legs are rarely ringed. The distal articles are often darker than proximal ones. The abdomen has various markings depending on size. Many have no markings on the venter. Most small species, those whose females are less than 2.5 mm total length, lack white pigment spots on the abdomen; have a broad gray or black band posteriorly, fading anteriorly (Fig. 11); have a venter with a square gray patch, gray book lung covers, gray spinnerets, and a gray patch on the sides posteriorly (Figs. 12, 20, 26). The largest species, females with total length of 5.0 mm and larger, usually have only a pair of square, gray or black patches on the dorsum posteriorly (Figs. 518, 522). The one exception here is the large *M. lactea* (Fig. 640), which lacks gray markings but has white pigment spots on the abdomen. The live coloration of only one species, *M. pia*, is known to be green (C. Craig, personal communication). Presumably others with the two black patches are also green. The intermediate-sized species have a diversity of markings (Figs. 160, 173, 240, 243). Because of the uniformity of markings of the smallest, and also the largest species, not all the abdomens in these two groups are illustrated.

The eyes are often relatively large (Fig. 188), and the posterior ones can have black rings. The posterior row may be procurved (Fig. 46), straight (Fig. 78), or recurved (Fig. 351). The posterior or anterior median eyes could be the largest, the laterals smallest, the anterior lateral eye slightly larger than the posterior. The distances of the eyes from each other are recorded for the types, but the distances can vary within a species. The clypeus height usually equals about the diameter of the anterior median eyes (Figs. 1, 3), rarely to 2.0 diameters and sometimes as little as 0.3 diameter. Its height is variable within species and sometimes is difficult to see because of transparency and softness of the clypeus margin. The first or fourth leg may be longest; the third is always shortest (Fig. 3). The legs have long upright macrosetae (Figs. 2, 3). The abdomen shape, although always longer than wide, varies in different species, being widest anteriorly, in the middle, or posteriorly.

The epigynum of females is simple but variable in widespread species. The epigyna of some species have the edge lobed, others have a tongue, and some have a scape with a pocket at its tip.

All males probably have a tooth or denticle on the endite, but it may be very small, barely perceptible. The first coxa of almost all males has a hook; in small species it can be a barely visible tooth, posteriorly on the rim, but in large species, the hook is well developed. Only *M. semiatra* and *M. paquisha* seem to lack a hook. In many species, the fourth femur of the male has a strong, often short, macroseta on the venter of its proximal end (Fig. 21). The differences of the complex palpi are better distinguishing characters for species than the female genitalia. The variation of the palpi arises from the shape of various sclerites, but the position of the sclerites stays about the same, making it easier to assign the males to species.

The mesal face of all, and the ventral of many, of the palpi were illustrated. But, the mesal view was found to be the most

useful in separating species (Fig. 189). One can usually find the embolus in the mesal or ventral view even if it is hidden behind a sclerite.

Males with a filamentous or sword-shaped embolus (Fig. 222) or with a projecting terminal apophysis (Fig. 217) are more easily determined than those without distinct or prominent sclerites (Fig. 244), in which case any small twist away from the view illustrated will make the palpus look different.

The labeled sclerites of palpi of two larger males are illustrated in Figures 627, 628, 642. Some palpal sclerites of small species are difficult to homologize unless the palpus is dissected. Grasshoff (1973) published on the morphology of *M. acalypha* (Walckenaer).

Distribution. Mangora species have not been found in Chile or on the Galapagos Islands, although a new, related genus with several species is found on Galapagos. The most abundant species and populations are in the Amazon (Map 6F), and some of these are widespread. But the species outside the Amazon and its tributaries are often localized and apparently less abundant. Only a few species are widespread: *M. melanocephala* (Map 2F), *M. dianasilvae* (Map 3F), and *M. novempupillata* (Map 4C). Large collections are available only from northern Argentina and southern Brazil. One can expect new species in the many uncollected areas.

SYNONYMS

Mangora bituberculata Mello-Leitão = *Mecynogea erythromela* (Holmberg). Synonymy by Levi (1997).

KEYS

The easiest characters are based on coloration of the specimen. Unfortunately, greens and reds wash out in alcohol and even black can fade over time. Also, it is not known how much the coloration pattern varies. Few specimens were available for each species and no color images. Other characters depend on the position of the epigynum and palpus being examined. The keys thus are limited.

In the keys and descriptions to females, the term "tongue" is used for a lobe extending from the epigynum that is too short and wide to be called a scape.

Speed Key for Females

1 Abdomen, dorsal view: one to three discrete, round black spots on each side, usually also a black spot on median anterior (Figs. 426, 432, 454).
Go to 1 in Key for Females, or if not, to 5 below.

5(1) Abdomen, dorsal view: with discrete, posterior median black band (Fig. 484); ventral: with pair of lateral bands (Figs. 485, 486); western Brazil.
Go to 5 in Key, or if not, to 6 below.

6(5) Thorax with light gray to black lateral bands (Figs. 130, 140, 196, 206).
Go to 6 in Key, or if not, to 14 below.

14(6) Abdomen without marks other than white pigment spots (Fig. 640) and larger than 4.8 mm; epigynum as in Figure 638; southeastern Bolivia, southern Brazil, northern Argentina.
Go to 14 in Key, or if not, to 15 below.

15(14) Abdomen, dorsal view: posterior with a pair of more or less discrete gray to black rectangles (Figs. 412, 531); most larger than 4 mm.
Go to 15 in Key, or if not, to 56 below.

56(15) Abdomen, dorsal view: with wide, longitudinal, posterior gray or black band, fading anteriorly (Figs. 11, 107, 112); venter with gray square or one or two rectangles (Figs. 12, 108, 113, 125); book lung covers usually gray (Figs. 20, 108); sides usually with gray patch (Figs. 26, 113), most less than 3 mm total length.
Go to 56 in Key, or if not, to 87 below.

87(56) Abdomen, dorsal view: with paired dorsal white patches on black (Figs. 247, 248); southern Guyana.
Go to 87 in Key, or if not, to 88 below.

88(87) Abdomen, dorsal view: all black with one to three white patches on sides (Figs. 385, 391).
Go to 88 in Key, or if not, to 95 below.

95(88) Abdomen with various patterns.
Go to 95 in Key.

Key for Females

1 Abdomen, dorsal view: one to three discrete, round black spots on each side, usually also a black spot on median anterior (Figs. 426, 432, 454) 2

– Abdomen without discrete, paired black spots 5

2(1) Abdomen, dorsal view: without anterior median spot (Fig. 432); epigynum, posterior view: median plate heart-shaped, longer than wide (Fig. 431); upper Amazon: Peru (Map 3D) .... *chanchamayo*

– Abdomen always with anterior median black spot (Fig. 426); epigynum other than heart-shaped posterior median plate 3

3(2) Epigynum, ventral view: rim with median notch (Figs. 450, 452); upper Amazon, Amazon region (Map 4C) .... *novempupillata*

– Ventral: rim without notch (Figs. 424, 438) 4

4(3) Epigynum, ventral view: with median short tongue (Figs. 436, 438, 440); posterior: with dorsolateral pockets (Figs. 437, 439, 441, 444, 542); upper Amazon, Amazon region (Map 4H) .... *mathani*

– Ventral: rim with a wide, curved lobe (Fig. 424); posterior: with pair of ventral semicircular slits (Fig. 425); upper Amazon: Peru (Map 4G) .... *comaina*

5(1) Abdomen, dorsal view: with discrete, posterior median black band and a pair of lateral spots (Fig. 484); ventral: with pair of lateral bands (Figs. 485, 486); upper Amazon: Brazil (Map 5C) .... *rondonia*

– Dorsal: no such discrete black bands present 6

6(5) Thorax with light gray to black lateral bands (Figs. 130, 140, 196, 206) 7

– Carapace without lateral bands (Figs. 25, 46) 14

7(6) Epigynum, ventral view: with spermathecae (as seen through integument) more than one and one-half times their diameter from rim (Figs. 137, 186, 199, 203) 8

– Ventral view: spermathecae one diameter or less from rim or not visible (Figs. 302, 309, 324) 11

8(7) Epigynum, ventral view: with a projecting, triangular tongue (Fig. 137); posterior: plates fused, with a dorsal pair of circular depressions (Fig. 138); Guianas, lower Amazon (Map 4A) .... *brokopondo*

– Ventral: without triangular tongue (Figs. 186, 199, 331); posterior: without dorsal pair of depressions (Figs. 187, 200, 332) 9

9(8) Epigynum, ventral view: rim with notch at each side of a short lobe (Fig. 331); posterior: median plate with almost parallel sides, slightly wider than lateral plates (Fig. 332); southern Brazil (Map 4B) .... *paranaiba*

– Ventral: rim without notches (Figs. 186, 199); posterior: median plate otherwise (Figs. 187, 200) 10

10(9) Epigynum posterior view: narrow, long median plate, with subparallel sides, subtriangular lateral plates with transverse folds (Figs. 200, 202, 204); ventral view: [plates along rim variable, often broken in midline, Figs. 199, 201, 203]; common, Mexico to northern Argentina (Map 2F) .... *melanocephala*

– Posterior: median plate hourglass-shaped (Fig. 187); ventral: with wide transverse unsclerotized band (Fig. 186); southwestern Colombia (Map 1I) .... *dagua*

11(7) Epigynum, ventral view: with dark, transverse mark near rim (Fig. 309); posterior: plates fused and pair of curved slits close to rim (Fig. 310); Suriname (Map 3E) .... *browns*

– Ventral: without transverse marks (Figs. 287, 302, 324); posterior: with plates distinct (Figs. 288, 303, 325) 12

12(11) Epigynum, ventral view: a thin lip on rim expanding at lateral ends (Figs. 302, 304); posterior: wide median plate with ventral curved slits close to rim (Figs. 303, 305); Trinidad, Amazon, to Peru, Mato Grosso, Brazil (Map 3F) .... (in part) *dianasilvae*

– Ventral and posterior: otherwise (Figs. 287, 288, 324, 325) 13

13(12) Epigynum, posterior view: median plate narrows dorsally, without depressions (Fig. 325); Amazon region, upper Amazon to southern Mato Grosso, Brazil (Map 3G) .... *chacobo*

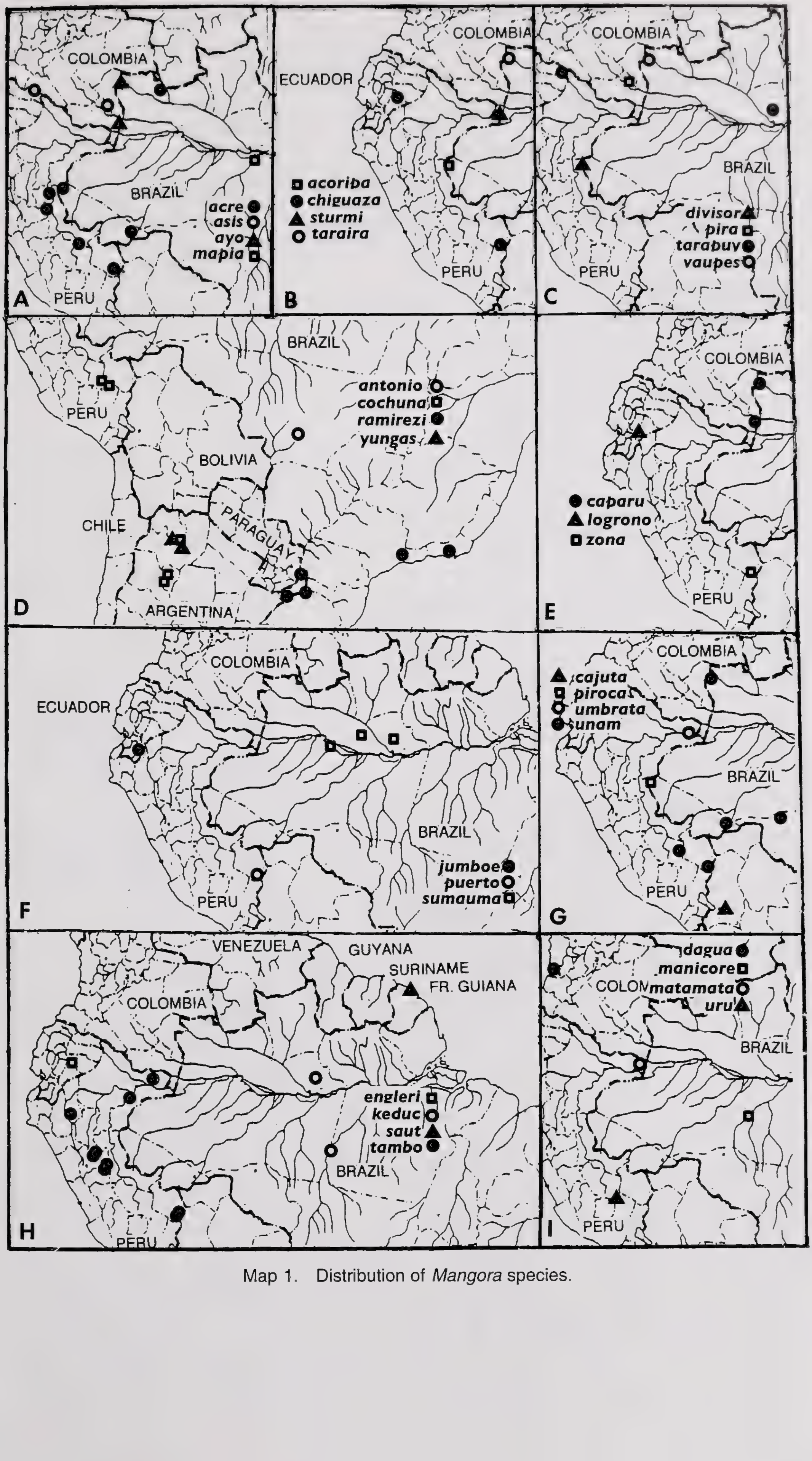
– Posterior: diamond-shaped median plate with ventral pair of circular depressions (Fig. 288); Amazon region (Map 3C) .... *isabel*

14(6) Abdomen without marks except white pigment spots (Fig. 640) and larger than 4.8 mm total length; epigynum as in Figures 638, 639; southeastern Bolivia, southern Brazil, northern Argentina (Map 6E) .... *lactea*

– Abdomen usually with marks, smaller size or different epigynum 15

15(14) Abdomen, dorsal view: posterior with pair of more or less discrete gray to

black rectangles (Figs. 412, 531); mostly larger than 4 mm 16
– Abdomen marked otherwise (and usually smaller size) 56
16(15) Epigynum venter: rim with median notch (Figs. 611, 616, 622, 629) 17
– Ventral: rim entire, straight, curved or with tongue or scape (Figs. 156, 164, 500) 21
17(16) Epigynum, posterior view: median plate diamond-shaped (Fig. 623); southern Brazil, northeastern Argentina (Map 6D) .... *strenua*
– Posterior: median plate shaped otherwise (Figs. 612, 630) 18
18(17) Epigynum, ventral view: notch flanked by sclerotized fold (Fig. 611); Panama to northern Brazil (Map 5H) .... *pia*
– Ventral: without sclerotized folds (Figs. 605, 616, 629) 19
19(18) Epigynum, posterior view: with one median ventral seam (Fig. 630); southeastern Brazil (Map 2D) .... *nonoai*
– Posterior: with median plate and with pair of ventral seams (Figs. 606, 617) 20
20(19) Epigynum, ventral view: a subrectangular base (Figs. 605, 607); posterior: median plate flanked by depressed lateral plates (Figs. 606, 608); upper Amazon: Colombia, Ecuador and western Brazil (Map 6C) .... *tefe*
– Ventral: a subtriangular base with median depression having a constriction (Fig. 616); posterior: median plate narrower than laterals with large ventral, bordered, triangular depression (Fig. 617); southwestern Colombia (Map 6B) .... *bambusa*
21(16) Epigynum, ventral view: a tongue or scape (Figs. 534, 563) 29
– Ventral view: rim straight (Fig. 500), or full width of rim curved (Figs. 164, 487) 22
22(21) Epigynum, ventral view: rim almost straight with pair of dark patches near rim (Fig. 500); posterior: median plate longer than wide (Fig. 501); northeastern Argentina (Map 5F) .... *vianai*
– Ventral: full width of rim curved (Figs. 156, 508, 516) 23
23(22) Epigynum, ventral view: full width of rim lobed into a tongue as long as wide anteriorly (Fig. 487); posterior: median, plate narrows dorsally (Fig. 488); southern Brazil, northeastern Argentina (Map 5F) .... *bemberg*
– Ventral: epigynum wider than long; posterior: median plate not narrowing dorsally (Figs. 159, 165, 517) 24
24(23) Epigynum, ventral view: with a pair of adjacent dark discs (center of Figs. 156, 164) 25
– Ventral: without such adjacent central discs (Figs. 508, 547) 26
25(24) Epigynum, ventral view: a tubercle on anterior of tongue (Fig. 164); southern Brazil (Map 2D) .... (in part) *velha*
– Ventral: a shallow, longitudinal groove anterior of tongue (Fig. 158); eastern Brazil to northeastern Argentina (Map 2C) .... (in part) *missa*
26(24) Epigynum, ventral view: a wide transverse groove with posterior thick lip (Fig. 516); posterior: median plate oval (Fig. 517); northern Peru (Map 5G) .... (in part) *kuntur*
– Ventral: rim without transverse groove (Figs. 497, 508) 27
27(26) Epigynum, posterior view: median plate subrectangular (Figs. 525, 528, 530); ventral tip of lobe often broken off (Figs. 524, 529); central Colombia (Map 5H) .... *fornicata*
– Posterior: median plate otherwise (Figs. 498, 509) 28
28(27) Epigynum, ventral view: rim forming tongue with slight depression of edge on each side; posterior: median plate with a ventral stalk flanked by swollen lateral plates (Fig. 509); southeastern Ecuador (Map 5C) .... *cutucu*
– Ventral: rim evenly rounded (Fig. 497); posterior: median plate with depressions flanking ventral short stalk (Fig. 498); northern Colombia (Map 5B) .... *kochalkai*
29(21) Epigynum, ventral view: with two arching loops and cup-shaped lobes on sides of scape (Fig. 478): upper Amazon: northern Peru (Map 5E) .... *explorama*
– Ventral: lacking arching loops and cup-shaped lobes (Fig. 458) 30
30(29) Epigynum, ventral view: ducts visible in lobes on anterior sides of scape (Figs. 458, 460); upper Amazon: Colombia to Mato Grosso, Brazil (Map 4E) .... *insperata*
– Ventral: no ducts visible (Figs. 586, 595) 31
31(30) Epigynum, ventral view: scape flanked by two, often sclerotized, lobes (swollen posterior lateral and median plates, Figs. 563, 577, 586) 32
– Ventral: scape flanked by only one lobe or without lobes on sides (Figs. 534, 547, 554) 41



Map 1. Distribution of *Mangora* species.

32(31) Epigynum, ventral view: with scape longer than wide anteriorly (Figs. 586, 590) ... 33

– Ventral: scape shorter than wide anteriorly, or length equals width (Figs. 563, 595) ... 34

33(32) Epigynum, ventral view: with small lobes flanked and in part covered by larger, lateral lobes (Fig. 590); Amazon region, Ecuador, Brazil, and Bolivia (Map 6A) ... *alinahui*

– Ventral: with lateral lobes tucked under median ones (Figs. 584, 586); southern Brazil, northeastern Argentina (Map 4F) ... *caxias*

34(32) Epigynum, ventral view: tongue without distal pocket or lip, both lobes wider than long (Fig. 534); upper Amazon: Brazil (Map. 5H) ... *taboquinha*

– Ventral: tongue with distal pocket or a lip (Fig. 568, 595) ... 35

35(34) Epigynum, posterior view: narrow median plate, constricted in middle (Fig. 596); upper Amazon: southern Ecuador, northwestern Peru (Map 6A) ... *lechugal*

– Posterior: median plate wider than long (Figs. 572, 578) ... 36

36(35) Epigynum, posterior view: with pair of facing thumbs along rim (Fig. 569); upper Amazon: central Peru (Map 5E) ... *laga*

– Posterior: without thumbs ... 37

37(36) Epigynum, posterior view: median plate bordered ventrally by a pair of triangular funnels (Figs. 564, 566); Guyana, Amazon region (Map 5E) ... *hirtipes*

– Posterior: without funnels ... 38

38(37) Epigynum, ventral view: short scape flanked by a sclerotized longitudinal lobes and less sclerotized lateral lobes (Figs. 577, 580); upper Amazon: southeastern Peru, western Brazil, northern Bolivia (Map 6A) ... *apobama*

– Ventral: without longitudinal lobes (Fig. 571) ... 39

39(38) Epigynum, ventral view: epigynum base with lateral, longitudinal swellings (Fig. 571); upper Amazon: eastern Peru (Map 5I) ... *moyobamba*

– Ventral: basal plate without lateral swellings (Figs. 557, 573) ... 40

40(39) Epigynum, posterior view: median plate widest ventrally and swollen at ventral margin (Figs. 573, 574); upper Amazon: central Peru (Map 6A) ... *nuco*

– Posterior: median plate oval, widest in center (Fig. 558); Ecuador (Map 6B) ... *palenque*

41(31) Epigynum, ventral view: tongue or scape with anterior constriction (Figs. 344, 491) ... 42

– Ventral: tongue not constricted anteriorly ... 43

42(41) Epigynum, ventral view: scape twice as long as wide (Fig. 491); southwestern Colombia (Map 5B) ... *eberhardi*

– Ventral: with scape as long as wide (Fig. 344); Venezuela to Panama (Map 3H) ... *falconae*

43(41) Epigynum, ventral view: sclerotized thick wide lip (Fig. 560); posterior: an hourglass-shaped median plate (Fig. 561); southwestern Ecuador, northwestern Peru (Map 6B) ... *colonche*

– Ventral and posterior: otherwise ... 44

44(43) Epigynum, posterior view: median plate diamond-shaped, lateral plates almost touching each other dorsally (Fig. 551); northeastern Peru (Map 5I) ... *porcullo*

– Posterior: median plate shaped otherwise (Figs. 539) ... 45

45(44) Epigynum, ventral view: scape longer than wide with parallel sides (Fig. 383); posterior: with pair of deep, narrow dorsoventral grooves (Fig. 384): Guianas and Amazon region (Map 5A) ... (in part) *uraricoera*

– Ventral: scape or tongue about as long as wide, or shorter ... 46

46(45) Epigynum, ventral view: tongue with a median, triangular, bordered swelling and posterior pocket (Fig. 600); upper Amazon: Colombia (Map 6C) ... *latica*

– Ventral: tongue or scape without median structure (Figs. 538, 547) ... 47

47(46) Epigynum, posterior view: median plate with ventral stalk (Figs. 548); northern Colombia (Map 5I) ... *socorpa*

– Posterior: median plate without stalk (Figs. 551) ... 48

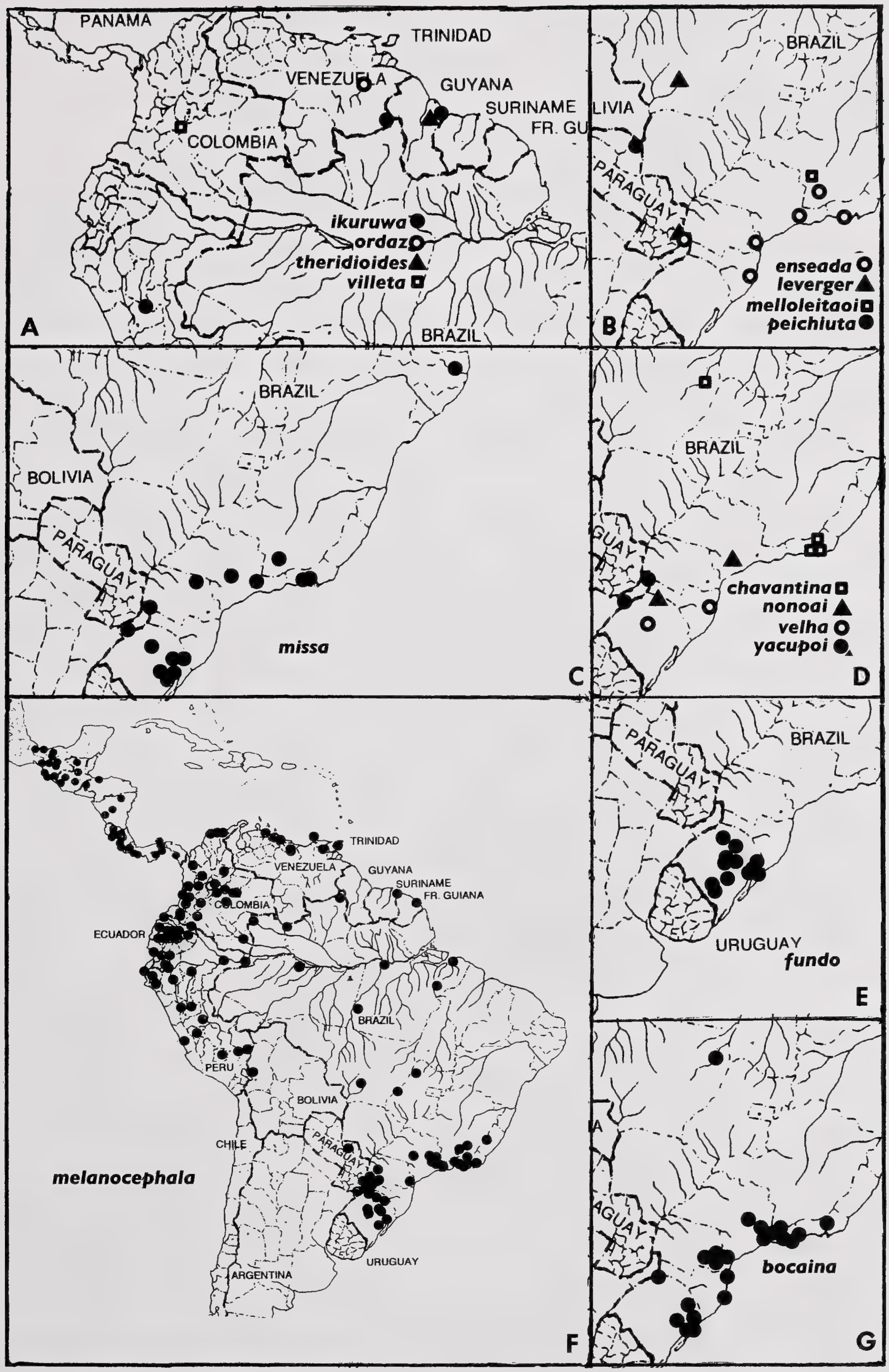
48(47) Epigynum, ventral view: frame of tongue extending to sides as a swollen lip (Fig. 538); posterior: oval median plate swollen on sides (Fig. 539); coastal Ecuador (Map 5H) ... *manglar*

– Ventral: tongue and rim of epigynum otherwise ... 49

49(48) Epigynum, posterior view: median plate wider than long (Fig. 544) ... 50

– Posterior: median plate longer than wide ... 51

50(49) Epigynum, posterior view: median plate oval, with a transverse swelling,



Map 2. Distribution of *Mangora* species.

sides convex (Fig. 544); Amazon region, east-central Brazil (Map 4D) .... *minacu*

– Posterior: median plate sides having a curved slit close to rim (Figs. 303, 305); Trinidad, Amazon, to Peru, Mato Grosso, Brazil (Map 3F) .... (in part) *dianasilvae*

51(49) Epigynum, posterior view: lateral plates fused dorsally, enclosing long median plate (Fig. 634); southeastern Brazil (Map 4I) .... *itatiaia*

– Posterior: lateral plates separated by median plate (Figs. 513, 521) 52

52(51) Epigynum, posterior view: median plate in a groove (Fig. 513); upper Amazon: central Peru (Map 5G) .... *oxapampa*

– Posterior: median plate otherwise (Figs. 411, 521) 53

53(52) Epigynum, posterior view: wide grooves flanking median plate (Fig. 521); central Colombia (Map 5G) .... *boyaca*

– Posterior: otherwise (Figs. 411, 555) 54

54(53) Epigynum, ventral view: scape wider than rim on sides (Fig. 410); posterior: lateral plates swollen (Fig. 411); Guyana and Amazon region, Brazil (Map 4E) .... *bovis*

– Ventral: scape as wide or narrower than sides of rim (Figs. 505, 554) 55

55(54) Epigynum, posterior view: median plate narrows dorsally (Fig. 506); central Peru (Map 5C) .... *tarma*

– Posterior: median plate not narrowing dorsally, lateral plates appear divided (Fig. 555); southern Colombia (Map 6B) .... *pepino*

56(15) Abdomen, dorsal view: with an anteriorly fading, wide, longitudinal, posterior gray or black band (Figs. 11, 107, 112); ventral: usually with black square or one or two rectangles (Figs. 12, 108, 113, 125); book lung covers usually gray (Figs. 20, 108); sides usually with gray patch (Figs. 26, 113); all less than 3 mm total length 57

– Abdomen with various patterns 87

57(56) Epigynum, ventral view: rim with shallow notch (Figs. 6, 42, 81) [some may be the result of a broken tip] 58

– Ventral: rim without shallow notch (Figs. 15, 48) 62

58(57) Epigynum, posterior view: with a median, circular depression (Fig. 43); Serra do Divisor, western Brazil (Map 1B) .... *acoripa*

– Posterior: without circular depression (Figs. 7, 82) 59

59(58) Epigynum, posterior view: sclerotized area square with dorsal lateral swellings (Fig. 82); upper Amazon: southern Colombia (Map 1B) .... *sturmi*

– Posterior: sclerotized area wider than long (Figs. 5, 10, 39) 60

60(59) Epigynum, posterior view: with transverse curved folds (Fig. 39); upper Amazon: Colombia (Map 1A) .... *asis*

– Posterior: without transverse folds (Figs. 5, 10) 61

61(60) Epigynum, posterior view: with dorsal, light median trapezoid (Figs. 5, 7); upper Amazon: Colombia, Peru, western Brazil (Map 1A) .... *acre*

– Posterior: with dorsal, dark median area (Fig. 10); central Amazon region (Map 1A) .... *mapia*

62(57) Epigynum, posterior view: with pair of deep depressions with lips (Fig. 415), the distance of their diameter from the rim; southeastern, southern Brazil (Map 4F) .... (in part) *blumenau*

– Posterior: without pair of deep depressions (Figs. 33, 49) 63

63(62) Posterior view with two adjacent black discs, ventral to a dorsal dark area containing depressions (Fig. 33); ventral: epigynum projecting from abdomen, no spermathecae visible (Fig. 32); Colombia (Map 1C) .... *pira*

– Posterior: otherwise 64

64(63) Epigynum, ventral view: full width of rim lobed, length less than one-third its width anteriorly, or rim straight (Figs. 15, 48) 65

– Ventral: with tongue or scape longer than one-half its width (Figs. 57, 96) 73

65(64) Epigynum, ventral view: with circular bulge (Fig. 405); southeastern Brazil (Map 4F) .... *castelo*

– Ventral: without circular bulge (Figs. 15, 48) 66

66(65) Epigynum, ventral view: with transverse groove anterior to rim (Fig. 15); posterior: also with transverse, oval groove (Fig. 16); southern Mato Grosso, Brazil to eastern Paraguay (Map 2B) .... *leverger*

– Ventral: without transverse groove (Figs. 44, 48, 414) 67

67(66) Epigynum, ventral view: with black rim and median black spot (Fig. 48); posterior: dorsal, light semicircle (Fig. 49); Serra do Divisor, western Brazil (Map 1C) .... *divisor*

– Ventral: otherwise; posterior: without

dorsal light semicircle (Figs. 18, 45) 68

68(67) Epigynum, posterior view: a large, semicircular, bordered depression (Fig. 45); Ecuador to central Amazon region (Map 1C) .... *tarapuy*

– Posterior: without bordered, semicircular depression (Figs. 18, 232) 69

69(68) Epigynum, ventral view: rim with thick lip and anterior median circular depression (Figs. 231, 233); southern Brazil, northern Argentina (Map 3B) .... *caballero*

– Ventral: without such depression and lip (Figs. 17, 27, 98) 70

70(69) Epigynum, posterior view: with pair of dark, shallow, dorsoventral grooves (Fig. 18); northern Venezuela (Map 4A) .... *grande*

– Posterior: with oval or round depressions (Figs. 28, 33) 71

71(70) Epigynum, posterior view: with two light spermathecae touching rim and showing through transparent integument (Fig. 28); upper Amazon: Colombia, southern Peru and western Brazil (Map 1G) .... *unam*

– Posterior: no spermathecae visible or spermathecae dark (Figs. 33, 86, 99) 72

72(71) Epigynum, ventral view: with a transverse swelling (Fig. 98); posterior with dark circles and two round depressions some distance from rim (Fig. 99); upper Amazon: southeastern Colombia (Map 1E) .... *caparu*

– Ventral: flat (Fig. 85); posterior: with two dark dorsal depressions (Fig. 86); upper Amazon: Colombia (Map 1B) .... *taraira*

73(64) Epigynum posterior: with dorsal opening having a dorsal lip, its width equals one-third of diameter of tongue (Fig. 117); Guyana, southern Venezuela, Peru (Map 2A) .... *ikuruwa*

– Posterior: otherwise (Figs. 92, 106, 111) 74

74(73) Epigynum, posterior view: transverse opening with width equals almost half width of tongue (Fig. 92); southeastern Ecuador (Map 1E) .... *logrono*

– Posterior: opening smaller (Figs. 106, 111) 75

75(74) Epigynum, posterior view: with dorsal light circle (Figs, 23, 111) or rectangular light area (Figs. 64, 106) 76

– Posterior: without dorsal light area (Figs. 66, 76, 357, 364) 79

76(75) Epigynum, posterior view: rectangular, light, dorsal depression (Figs. 64, 106) 77

– Posterior: with round depression (Figs. 23, 111) 78

77(73) Epigynum, ventral view: without black line across anterior of tongue (Fig. 105); posterior: five adjacent dorsoventral swellings (Fig. 106); Amazon region (Map 1I) .... *manicore*

– Ventral: a black line across anterior of tongue (Fig. 63); posterior: with four bulges (Fig. 64); Serra do Divisor, western Brazil (Map 1G) .... *piroca*

78(76) Epigynum, posterior view: light semicircular opening between swollen ridges (Fig. 111); southeastern Ecuador (Map 1F) .... *jumboe*

– Posterior: dorsal, median light semicircular opening surrounded by a black area (Fig. 23); upper Amazon: Ecuador to southern Peru (Map 1B) .... *chiguaza*

79(75) Epigynum, ventral view: notches flanking scape (Figs. 356, 363) 80

– Ventral: without notches on sides of scape (Figs. 75, 76, 317) 81

80(79) Epigynum, ventral view: scape as wide as long (Fig. 356); posterior: median plate, heart-shaped (Fig. 357); southern Brazil to southern Bolivia and northwestern Argentina (Map 4B) .... (in part) *v-signata*

– Ventral: scape longer than wide (Fig. 363); posterior: median plate with parallel sides, same width as lateral plates (Fig. 364); southern Bolivia, northwestern Argentina (Map 4D) .... (in part) *chuquisaca*

81(79) Epigynum, ventral view: pair of ducts, looping anteriorly (Fig. 57); upper Amazon: northeastern Peru (Map 1G) .... *umbrata*

– Ventral: without looping ducts (Figs. 87, 100) 82

82(81) Epigynum, ventral view: full width of rim lobed (Figs. 87, 100) 84

– Ventral: tongue set off from rim (Figs. 51, 65) 83

83(82) Epigynum, posterior view: a wide lip along rim (Fig. 66); ventral spermathecae separate, with pair of posterior transverse swellings (Fig. 65); Mato Grosso, Brazil (Map 1D) .... *antonio*

– Posterior: without wide lip, with dorsal, slit-shaped, lateral facing openings, within a dark circles (Fig. 52); upper Amazon: southern Peru (Map 1E) .... *zona*

84(82) Epigynum, ventral view: ventral visible spermathecae separated by their diameter (Figs. 96, 100) 85

– Ventral: spermathecae touching or not visible (Figs. 87, 122) 86

85(84) Epigynum, posterior view: with pair of adjacent dorsoventral oval depressions (Fig. 101); upper Amazon: southeastern Colombia (Map 1I) .... *matamata*

– Posterior: with pair of adjacent dark depressions (Fig. 97); upper Amazon: southeastern Colombia (Map 1A) .... (in part) *ayo*

86(84) Epigynum, posterior view: with two pairs of light rings showing through integument (Fig. 88); upper Amazon: southeastern Colombia (Map 1C) .... *vaupes*

– Posterior: no rings showing; with pair of dark, circular depressions each with a dark ventral extension (Fig. 123); Amazon region (Map 1F) .... *sumauma*

87(56) Abdomen, dorsal view: with paired dorsal white patches on black (Figs. 247, 248); southern Guyana (Map 3C) .... *shudikar*

– Dorsal: all black with white lateral patches or other diverse, dorsal patterns (Figs. 321, 385) 88

88(87) Abdomen, dorsal view: all black with one to three white patches on sides (Figs. 385, 391) 89

– Dorsal: with various patterns (Figs. 328, 333) 95

89(88) Epigynum, ventral view: with transverse groove (Fig. 516); northern Peru (Map 5G) .... (in part) *kuntur*

– Ventral: without transverse groove (Figs. 383, 389) 90

90(89) Epigynum, ventral view: with scape longer than wide (Figs. 383, 389) 91

– Ventral: tongue, wider than long (Figs. 218, 223, 313) 92

91(90) Epigynum, ventral view: scape with parallel sides (Fig. 383); posterior: with two deep, bordered grooves (Fig. 384); Guianas, Amazon region, upper Amazon (Map 5A) .... (in part) *uraricoera*

– Ventral: scape with sides sloping, tip pointed (Fig. 389); posterior: two long, pointed triangular, lateral plates (Fig. 390); Mato Grosso, Brazil (Map 4E) .... *aripuana*

92(90) Epigynum, ventral view: with sides of rim sclerotized, spermathecae showing through the integument, next to V-shaped, longitudinal; triangular lobes (Fig. 218); upper Amazon: southern Peru (Map 1F) .... *puerto*

– Ventral: without sclerotized lobes on sides (Figs. 223, 269) 93

93(92) Epigynum, ventral view: with a pair of sclerotized circular holes on sides of rim (Fig. 313); posterior: median plate twice as wide as long (Fig. 314); coast of Venezuela, Colombia to upper Amazon region, Peru (Map 3E) .... *semiatra*

– Ventral: lacking circular holes on each side; posterior: median plate one and at most three-quarters as wide as long (Figs. 224, 270) 94

94(93) Epigynum, ventral view: rim with lateral angles and small, round tongue (Fig. 223); Paraguay, northeastern Argentina (Map 3A) .... *uziga*

– Ventral view: rim lacking sclerotized lateral angles, tongue pointed (Fig. 269); upper Amazon region: Peru to Bolivia (Map 3D) .... (in part) *huallaga*

95(88) Epigynum, ventral view: with visible, transverse ducts (Fig. 465); posterior: heart-shaped median plate (Fig. 466); southern Brazil (Map 4I) .... *sobradinho*

– Ventral: without transverse, visible ducts 96

96(95) Epigynum, ventral view: rim of sclerotized base with median groove or notch (Figs. 401, 402) 97

– Ventral: rim without median notch, rim straight, with tongue or scape (Figs. 127, 293) 101

97(96) Epigynum, lateral view: a semicircular projection (Fig. 403); ventral: with small median lobe (as seen from slightly anterior, Fig. 401); Amazon region (Map 4A) .... *argenteostriata*

– Ventral: epigynum otherwise (Figs. 170, 241) 98

98(97) Epigynum, ventral view: rim with median notch covered by soft tissue (Figs. 170, 177) 99

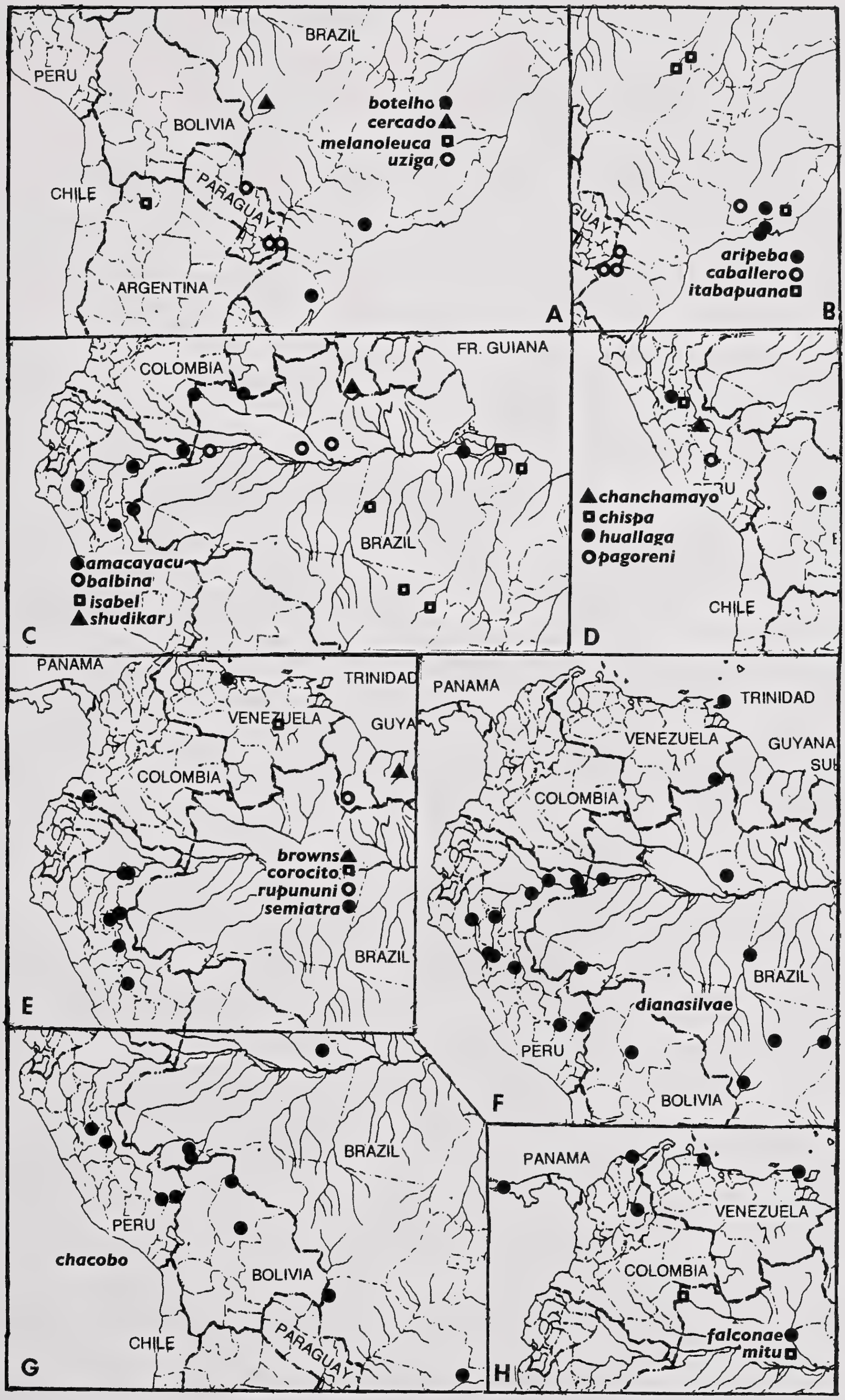
– Ventral: median septum of venter showing through a gap (Figs. 191, 193, 241) 100

99(98) Epigynum, ventral view: tubercle anterior to notch (Fig. 170); southern Brazil (Map 2E) .... *fundo*

– Ventral: with shallow longitudinal groove anterior to notch, notch with anterior longitudinal slit (Fig. 177); Mato Grosso to southern Brazil (Map 2G) .... *bocaina*

100(98) Epigynum, posterior view: lateral plates with parallel margins above the median plate (Fig. 242); northern Argentina (Map 3A) .... *melanoleuca*

– Posterior: lateral plates with concave



Map 3. Distribution of *Mangora* species.

margins above median plate (Figs. 192, 194); northeastern Argentina (Map 2D) .... *yacupoi*

101(96) Epigynum, ventral view: with projecting shelf, with median anterior edge extending (Fig. 397); posterior: median plate with slightly convex margins (Fig. 398); southwestern Colombia (Map 5B) .... *barba*

– Ventral: otherwise 102

102(101) Epigynum, ventral view: rim straight (Fig. 148) or the total width of rim curved, lobed (Figs. 127, 212) 103

– Ventral: with set off tongue or scape (Figs. 298, 367) 106

103(102) Epigynum, ventral view: with upside-down T-shaped raise dividing a pair of depressions (Fig. 148); northern Paraguay (Map 2B) .... *peichiuta*

– Epigynum, ventral view: otherwise (Figs. 212, 516) 104

104(103) Epigynum, posterior view: with two transverse slits in dark circles (Fig. 128); ventral: with triangular lobe (Fig. 127); southeastern Ecuador (Map 1H) .... *engleri*

– Posterior: without transverse slits in dark discs (Figs. 213, 259) 105

105(104) Epigynum, posterior view: with depression on tip and dorsal transverse slits (Fig. 213); French Guiana (Map 1H) .... *saut*

– Posterior: with pair of depressions, posterior plates fused (Figs. 259, 261); ventral: a pair of black spermathecae and lighter area anterior to rim (Figs. 258, 260); Amazon region (Map 3C) .... *balbina*

106(102) Epigynum, ventral view: tongue or scape slightly constricted anteriorly (Figs. 238, 349, 367, 372, 377) 107

– Ventral: tongue or scape without anterior constriction (Figs. 296, 356, 363) 113

107(106) Epigynum, posterior view: median plate, U-shaped, wider than long (Fig. 378); Panama, Trinidad, Venezuela, northern Colombia (Map 4A) .... *amchickeringi*

– Posterior: median plate otherwise (Figs. 338, 473) 108

108(107) Epigynum, ventral view: a projecting lobe on each side of scape (Figs. 367, 369); posterior view: lateral plates about as wide as scape, median plate short (Figs. 368, 370); upper Amazon: Peru (Map 5D) .... *punctipes*

– Ventral: without projecting lobes (Fig. 372); posterior: otherwise (Figs. 373, 473) 109

109(108) Epigynum, posterior view: a large oval median plate, lateral plates a thin lip (Fig. 473); Amazon region (Map 5C) .... *mamiraua*

– Posterior: median plate other shape (Figs. 338, 350) 110

110(109) Epigynum, posterior view: oval lateral plates with convex border overhanging median plate (Fig. 338); southeastern Ecuador, Amazon region, Brazil (Map 5D) .... *morona*

– Posterior: lateral plates not oval, borders more or less parallel (Figs. 239, 350) 111

111(110) Epigynum, ventral view: tongue small, twice as long as wide (Fig. 238); posterior: median plate wider than laterals (Fig. 239); southern Mato Grosso, Brazil (Map 3A) .... *cercado*

– Ventral: tongue large, median plate width equals that of lateral plates (Figs. 349, 372) 112

112(111) Epigynum, posterior: lateral plates with black patch (Fig. 373); southern Brazil (Map 4D) .... *paula*

– Posterior: lateral plates without black patch (Fig. 350); Córdoba, north central Argentina (Map 4B) .... *sciosciae*

113(106) Epigynum, ventral view: scape with parallel sides (Figs. 75, 356) 114

– Ventral: tongue diminishing in width (Figs. 298, 353) 118

114(113) Epigynum, ventral view: a notch flanking scape (Figs. 356, 363) 115

– Ventral: lacking notches on sides of scape (Figs. 75, 317) 117

115(114) Epigynum, posterior view: median plate, heart-shaped (Fig. 357); southern Brazil to southern Bolivia, northern Argentina (Map 4B) .... (in part) *v-signata*

– Posterior: median plate with parallel sides 116

116(115) Epigynum, ventral view: notches of rim about their diameter apart (Fig. 363); southern Bolivia, northern Argentina (Map 4D) .... (in part) *chuquisaca*

– Ventral: notches of rim more than two times their diameters apart (Fig. 70); mountains of Cuzco, Peru, to northern Argentina (Map 1D) .... *cochuna*

117(114) Epigynum, posterior view: plates appear fused, with two deep longitudinal grooves divided by a septum (Fig. 76); Guyana (Map 2A) .... *theridioides*

– Posterior: border of median plate turning lateral ventrally; median plate appearing mushroom-shaped (Figs.

318, 320); Amazon region to eastern Paraguay (Map 4D) .... *chao*

118(113) Abdomen, dorsal view: with anterior, median, gray or black mark (Figs. 257, 295, 299) 119

– Dorsal: without anterior median marks 123

119(118) Epigynum, posterior view: with pair of small deep, bordered depressions a distance less than their diameter from rim in a triangular sclerotized area (Fig. 297); southern Brazil, northeastern Argentina (Map 1D) .... *ramirezi*

– Posterior: without such depressions 120

120(119) Epigynum, ventral view: with a tongue almost as long as wide (Fig. 353); posterior: median plate oval with convex sides (Fig. 354); central Peru (Map 5D) .... *taczanowskii*

– Ventral: length of tongue less than two-thirds its width (Fig. 293); posterior: otherwise 121

121(120) Epigynum, posterior view: with wide swollen parallel sided median plate (Fig, 394); southern Brazil (Map 4F) .... *maximiano*

– Posterior: with median plate indistinct or fused to laterals (Figs. 252, 294) 122

122(121) Epigynum, ventral view: rim with a minute pointed lobe, attached to a semicircular basal plate (Figs. 251, 253); Amazon region: Brazil to Peru (Map 3C) .... *amacayacu*

– Ventral: with pointed scape-like lobe on surface of base, its tip two-thirds width of adjacent areas (Fig. 293); upper Amazon: Peru (Map 3D) .... *chispa*

123(118) Epigynum, posterior view: with a pair of deep, bordered depressions, about the distance of their length from the rim based on a rectangular sclerotized area (Fig. 415); southern Brazil (Map 4F) .... (in part) *blumenau*

– Posterior: otherwise (Figs. 133, 270, 281) 124

124(123) Epigynum, posterior view: a sclerotized shield, longer than wide, plates fused, a pair of shallow grooves with dorsolateral slits (Fig. 133); southeastern Brazil, northeastern Argentina (Map 2B) .... *enseada*

– Posterior: wider than long; plates not fused (Figs. 270, 281) 125

125(124) Epigynum, posterior view: large, transverse, oval median plate with narrow lateral plates (Fig. 270); upper Amazon: Peru to Bolivia (Map 3D) .... (in part) *huallaga*

– Posterior: median plate with more or less parallel sides 126

126(125) Epigynum, ventral view: with a central pair of adjacent, dark circles, (center of Figs. 156, 164) 127

– Ventral: without adjacent, dark, circles (Figs. 264, 280) 128

127(126) Epigynum, ventral view: with tubercle on anterior of tongue (Fig. 164); southeastern Brazil (Map 2D) .... (in part) *velha*

– Ventral: with shallow, median, longitudinal groove anterior of tongue (Fig. 158); southeastern Brazil to northeastern Argentina (Map 2C) .... (in part) *missa*

128(126) Epigynum, ventral view: with anterior margin of tongue pocket forming a line with the rim (Fig. 264); southeastern Brazil (Map 3B) .... *aripeba*

– Ventral: with pair of circular structures flanking tongue whose lips continue with the circles (Figs. 274, 280) 129

129(128) Epigynum, posterior view: median plate ventrally without borders, fused to lateral plates (Fig. 281); southern Guyana (Map 3E) .... *rupununi*

– Posterior: median plate with borders to rim (Figs. 275, 284); Tocantins, southeastern Brazil (Map 3B) .... *itabapuana*

SPEED KEY FOR MALES

(Left palpi are used; for their nomenclature, see Figs. 627, 628, 642.)

1 Palpal cymbium with macrosetae in a row above paracymbium (Fig. 249).
Go to 1 in Key for Males, or if not, to 2 below.

2(1) Abdomen, dorsal view: with three or more discrete, round black spots (Figs. 418, 422).
Go to 2 in Key, or if not, to 9 below.

9(2) Thorax with black or gray sides (Figs. 206, 307).
Go to 9 in Key, or if not, to 19 below.

19(9) Palpus: cymbium with proximal, dorsal, projecting tubercle (Figs. 146, 147, 152, 153).
Go to 19 in Key, or if not, to 21 below.

21(19) Palpus, mesal view: median apophysis with a proximal lobe or spine (left on median apophysis in figures of left palpi, 6 h in Fig. 126), or two lobes or spines, one on each end (7 h in Fig. 13); with a macroseta on venter proximal on femur of leg IV (Fig. 21).
Go to 21 in Key, or if not, to 29 below.

29(21) Same as 21, but without macroseta on venter proximal on femur of leg IV.
Go to 29 in Key, or if not, to 44 below.
44(29) Palpus, mesal view: median apophysis with only distal lobe or spine (right on median apophysis in figures of left palpus (6 h in Fig. 168) or no spine or distinct lobe. Fourth femur with proximal ventral macroseta (Fig. 21).
Go to 44 in Key or if not, to 57 below.
57(44) Same as 44, but without proximal ventral macroseta on femur of leg IV.
Go to 57 in Key.

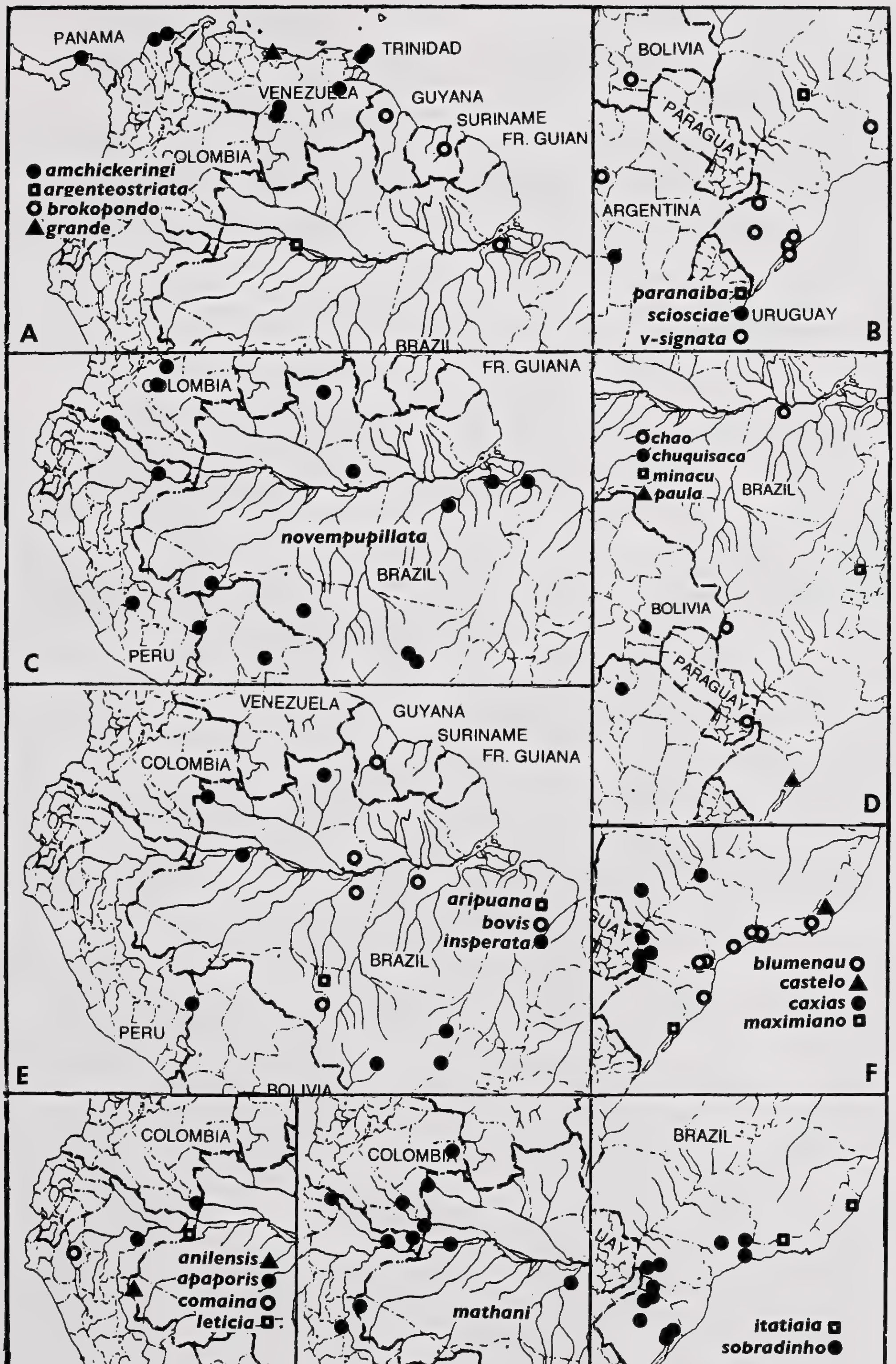
Key for Males

1 Palpus: cymbium with macrosetae in a row above paracymbium (Fig. 249); Cuzco, Peru (Map 3D) .... *pagoreni*
– Cymbium without such macrosetae 2

2(1) Abdomen, dorsal view: with three or more discrete, round black spots (Figs. 418, 422) 3
– Abdomen coloration otherwise 9
3(2) Palpus, mesal view: median apophysis with proximal lobe (7 h in Fig. 420, 6 h in Figs. 447, 456) 4
– Median apophysis without proximal lobe (Figs. 423, 429) 6
4(3) Palpus, mesal view: conductor with triangular apophysis and rugose bulge (center of Fig. 456); Amazon region, upper Amazon (Map 4C) .... *novempupillata*
– Conductor shaped differently (Figs. 420, 447) 5
5(4) Palpus, mesal view: conductor with sclerotized, flat, truncate lateral shield (center of Figs. 447, 448); Amazon region, upper Amazon (Map 4H) .... *mathani*
– Conductor (below embolus) subtriangular; embolus slightly curved (1 h in Fig. 420); upper Amazon: western Brazil (Map 4G) .... *anilensis*
6(3) Palpus, mesal view: visible conductor (below embolus) semicircular; a projecting lobe above embolus (2–3 h in Fig. 429); upper Amazon: Colombia (Map 4G) .... *leticia*
– Conductor and embolus shaped differently (Figs. 423, 427) 7
7(6) Palpus, mesal view: large, distal round lobe above embolus (2 h in Fig. 423); upper Amazon: Colombia, northern Peru (Map 4G) .... *apaporis*
– Embolus without distal round lobe (Figs. 427, 435) 8
8(7) Palpus, mesal view: conductor triangular (below embolus in Fig. 435); upper Amazon: central Peru (Map 5D) .... *huancabamba*
– Conductor, subrectangular (below embolus in Fig. 427); northern Peru (Map 4G) .... *comaina*

9(2) Thorax with black or gray sides (Figs. 206, 307) 10
– Thorax without gray or black sides 19
10(9) Fourth femur with ventral, proximal macroseta (Fig. 21) 11
– Fourth femur without macroseta 15
11(10) Palpus: terminal apophysis projecting distally (1 h in Figs. 197, 208, 209, 211) 12
– Terminal apophysis confined 13
12(11) Palpus, mesal view: long, wide embolus appearing broken (Figs. 208–210); common, Mexico to northern Argentina (Map 2F) .... *melanocephala*
– Embolus entire (Figs. 197, 198); western Venezuela (Map 2A) .... *ordaz*
13(11) Palpus, mesal view: lobe above embolus transparent (2 h in Fig. 330); Amazon region, upper Amazon to southern Mato Grosso, Brazil (Map 3G) .... *chacobo*
– Lobe above embolus otherwise (Fig. 131) 14
14(13) Palpus, mesal view: a large, round lobe above embolus (1 h in Fig. 131); upper Amazon: Peru (Map 1H) .... *tambo*
– Small distal lobe above embolus (1 h in Fig. 115); Amazon region (Map 1H) .... *keduc*
15(10) Palpus, mesal view: embolus long, curved; median apophysis with distal cylindrical lobe (Figs. 189, 308) 16
– Embolus short or hidden; median apophysis otherwise (Figs. 291, 335) 17
16(15) Palpus, mesal view: embolus short, base wide; median apophysis cylindrical lobe projecting ventrally from palpus (Fig. 308); Trinidad, Amazon region: Peru to southern Mato Grosso, Brazil (Map 3F) .... *dianasilvae*
– Embolus longer, evenly curved, median apophysis cylindrical projecting lobe (5 h in Fig. 189); southwestern Colombia (Map 1I) .... *dagua*
17(15) Palpus, mesal view: terminal apophysis with distal thorn (2 h in Fig. 335, Fig. 336); central Colombia (Map 5B) .... *zepol*
– Terminal apophysis without distal thorn (Figs. 291, 342) 18
18(17) Palpus, mesal view: conductor with a short distal lobe (3 h in Fig. 342); upper Amazon: Colombia (Map 3H) .... *mitu*
– Conductor subcircular without distal lobe (2 h in Fig. 291); Amazon region (Map 3C) .... *isabel*

19(9) Palpus: cymbium with proximal, dorsal, projecting tubercle (Figs. 146, 147, 152, 153) 20



Map 4. Distribution of *Mangora* species.

– Cymbium with tubercle absent or very small 21

20(19) Palpus, mesal view: embolus pointing distally (Fig. 146); central Colombia (Map 2A) .... *villeta*

– Embolus pointing toward ventral side (Fig. 152); northern Paraguay (Map 2B) .... *peichiuta*

21(19) Palpus, mesal view: median apophysis with a proximal lobe or spine (left on median apophysis in Figures of left palpi, 6 h in Fig. 126), or two lobes or spines, one on each end (7 h in Fig. 13) 22

– Median apophysis with only one distal lobe or spine (right on median apophysis in Figures of left palpus, (6 h in Fig. 168) or no spine or distinct lobe 44

22(21) Fourth femur with ventral proximal macroseta (Fig. 21) 23

– Fourth femur without macroseta 29

23(22) Palpus, mesal view: terminal apophysis with a distally indented projecting sclerite (2 h in Figs. 603, 610) 24

– Terminal apophysis otherwise 25

24(23) Palpus, mesal view: terminal apophysis projecting beyond bulb with length equal to width (2 h in Fig. 610); upper Amazon: Colombia, Ecuador, western Brazil (Map 6C) .... *tefe*

– Terminal apophysis projecting less than its width (2 h in Fig. 603); upper Amazon: Central Peru (Map 6C) .... *woytkowskii*

25(23) Palpus, mesal view: embolus filamentous, pointing to 3 h (center Fig. 511); southern Brazil (Map 5F) .... *florestal*

– Embolus short (Figs. 347, 583) 26

26(25) Palpus, mesal view: proximal projection of median apophysis bent apically (7 h in Fig. 36); embolus pointing to 1 h; upper Amazon: Colombia (Map 1C) .... *pira*

– Median apophysis proximal projection otherwise (Figs. 347, 375) 27

27(26) Palpus, mesal view: median apophysis with pair of short sharp spines; embolus hidden (Fig. 375); southern Brazil (Map 4D) .... *paula*

– Median apophysis with blunt spines (Figs. 347, 583); embolus exposed 28

28(27) Palpus, mesal view: embolus slightly curved (center of Fig. 583); upper Amazon: southeastern Peru, Brazil, Bolivia (Map 6A) .... *apobama*

– Embolus triangular, straight (center of Fig. 347); Panama, Venezuela (Map 3H) .... *falconae*

29(22) Palpus, mesal view: median apophysis with only one proximal lobe or spine (Figs. 121, 388) 30

– Median apophysis with spines or lobes, one on each end (Figs. 217, 532) 34

30(29) Palpus, mesal view: proximal spine of median apophysis pointed, curled, pointing toward tibia (Figs. 121, 126) 31

– Proximal view spine not curled facing down or a blunt lobe present (Fig. 273) 32

31(30) Palpus, mesal view: conductor subrectangular (3 h in Fig. 121); Guyana, southern Venezuela, Peru (Map 2A) .... *ikuruwa*

– Conductor semicircular (Fig. 126); Amazon region (Map 1F) .... *sumauma*

32(30) Palpus, mesal view: proximal spine of median apophysis pointing apical (Fig. 388); Guianas, Amazon region (Map 5A) .... *uraricoera*

– Proximal lobe or spine horizontal or pointing toward tibia (Figs. 50, 273) 33

33(32) Palpus, mesal view: median apophysis with proximal lobe pointing toward tibia (Fig. 273); upper Amazon: Peru to Bolivia (Map 3D) .... *huallaga*

– Median apophysis spine straight (Fig. 50); western Brazil (Map 1C) .... *divisor*

34(29) Palpus, mesal view: proximal end of median apophysis with a blunt lobe (Figs. 8, 13, 135) 35

– Proximal end with pointed spine (Figs. 104, 476) or pointed triangle (Fig. 532) 39

35(34) Palpus, mesal view: proximal end with lobe hanging down toward tibia (Fig. 13); Amazon region (Map 1A) .... *mapia*

– Proximal lobe straight, pointing to cymbium or pointing apically (Figs. 135, 163) 36

36(35) Palpus, mesal view: proximal and distal ends of median apophysis pointing apically (Fig. 163); southeastern Brazil to northeastern Argentina (Map 2C) .... *missa*

– Proximal lobe more or less straight, pointing to cymbium (Figs. 8, 217) 37

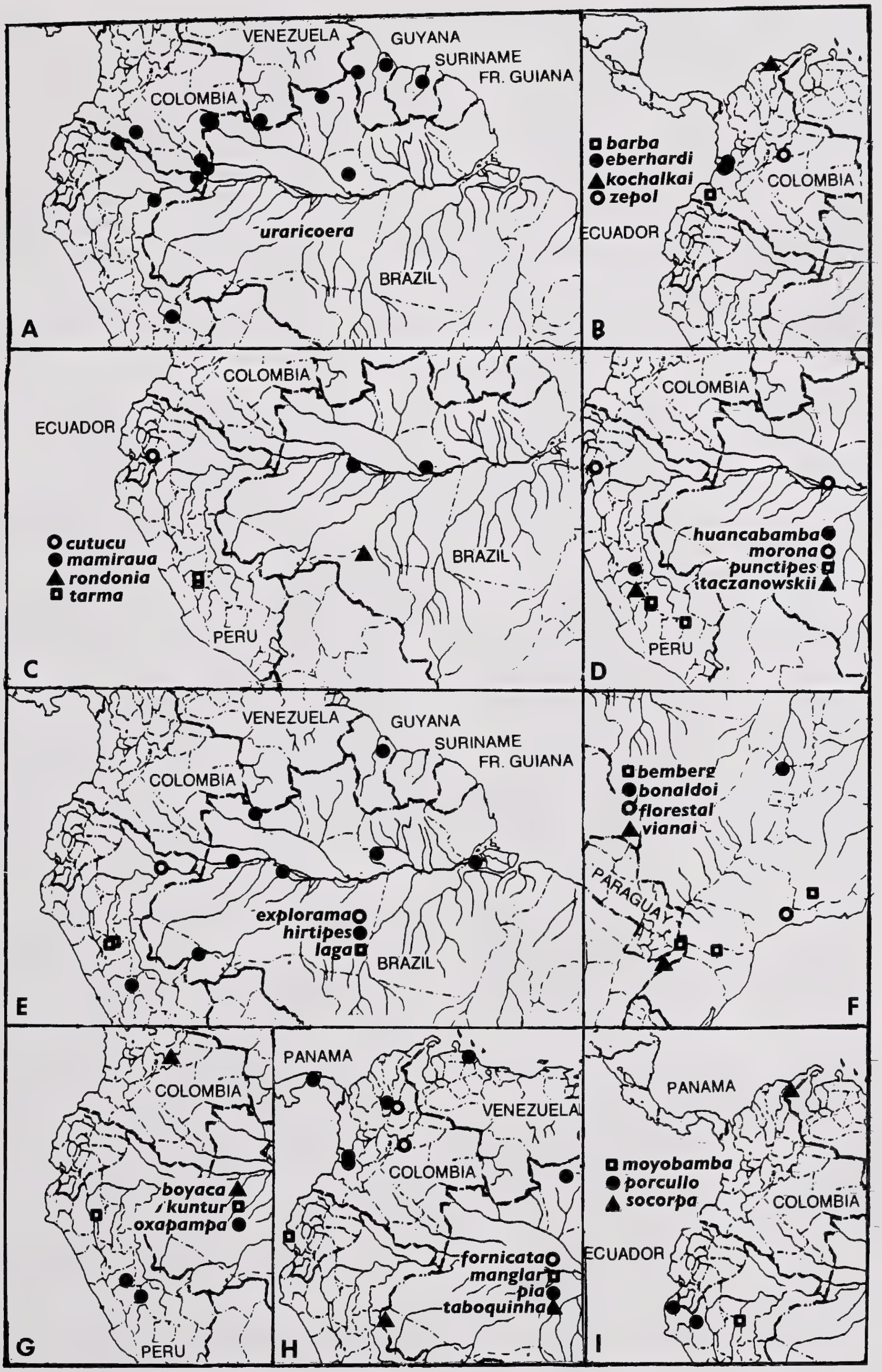
37(36) Palpus, mesal view: embolus long, semicircular (Fig. 217); Mato Grosso to Rio de Janeiro States, Brazil (Map 2D) .... *chavantina*

– Embolus short (Figs. 8, 135) 38

38(37) Palpus, mesal view: a pointed shield with two-pointed projection covering most of bulb (Fig. 135); southern Brazil, northeastern Argentina (Map 2B) .... *enseada*

– No shield; embolus triangular (Fig. 8); upper Amazon: Colombia, Peru, western Brazil (Map 1A) .... *acre*

39(34) Palpus, mesal view: proximal projection a



Map 5. Distribution of *Mangora* species.

pointed triangle above median apophysis attachment (Fig. 532); central Colombia (Map 5H) .... *fornicate*
– Proximal projection a pointed spine (Figs. 104, 476) 40
40(39) Palpus, mesal view: proximal spine of median apophysis pointing apically (Fig. 476); Amazon region (Map 5C) .... *mamiraua*
– Proximal spine pointing toward cymbium (Figs. 104, 322) 41
41(40) Palpus, mesal view: visible embolus a curved saber (Fig. 104); upper Amazon: southeastern Colombia (Map 1I) .... *matamata*
– Embolus straight or hidden in mesal view (Figs. 244, 322, 381) 42
42(41) Palpus, mesal view: embolus straight (one-third from top of Fig. 322); Amazon region to eastern Paraguay (Map 4D) .... *chao*
– Embolus mostly hidden (Figs. 244, 381) 43
43(42) Palpus, mesal view: embolus hidden by a large sclerotized, distally rounded lobe (2 h in Fig. 381); Panama, Trinidad, Venezuela, northern Colombia (Map 4A) .... *amchickeringi*
– Embolus mostly hidden by a pointed lobe (Fig. 244); northwestern Argentina (Map 3A) .... *melanoleuca*

44(21) Fourth femur with proximal ventral macroseta (Fig. 21) 45
– Fourth femur lacking a proximal ventral macroseta 57
45(44) Palpus: the terminal apophysis projecting apically beyond bulb (Figs. 489, 490); southern Brazil to northeastern Argentina (Map 5F) .... *bemberg*
– No such straight, projecting terminal apophysis 46
46(45) Palpus, mesal view: median apophysis with a distal, truncate lobe having a triangular projection (Fig. 614); Panama to northern Brazil (Map 5H) .... *pia*
– Median apophysis with distal lobe lacking triangular projection or spine (Figs. 463, 576) 47
47(46) Palpus, mesal view: median apophysis with distal lobe truncate or rounded (Figs. 463, 576) 48
– Median apophysis with a pointed spine 52
48(47) Palpus, mesal view: median apophysis lobe appearing truncate (Fig. 576); upper Amazon: central Peru (Map 6A) .... *nuco*
– Median apophysis lobe appearing rounded (Figs. 463, 598, 620) 49
49(48) Palpus, mesal view: embolus sword-shaped (Fig. 463); Colombia to Mato Grosso, Brazil (Map 4E) .... *insperata*
– Embolus short, flat-triangular 50
50(49) Palpus, mesal view: terminal apophysis with upright sclerite having two or three wide, ventral spines (12–2 h in Figs. 598, 620) 51
– Terminal apophysis lacking upright sclerite with two or three spines (Fig. 589); southern Brazil, northeastern Argentina (Map 4F) .... *caxias*
51(50) Palpus, mesal view: upright sclerite with upper notch wider than long (Fig. 620); southwestern Colombia (Map 6B) .... *bambusa*
– Upright sclerite with upper notch as long as wide (Fig. 598); southern Ecuador, northwestern Peru (Map 6A) .... *lechugal*
52(47) Palpus, ventral view: spine almost length of median apophysis (Figs. 80, 570) 53
– Spine of median apophysis short (Fig. 470) 54
53(52) Palpus, mesal view: terminal apophysis with projecting curved apical hook (1 h Fig. 79); upper Amazon: central Peru (Map 1I) .... *uru*
– Terminal apophysis lacking projecting hook (Fig. 570); upper Amazon: central Peru (Map 5E) .... *laga*
54(52) Palpus, mesal view: terminal apophysis with broad sclerotized shield covering distal half of bulb (Fig. 504); northeastern Argentina (Map 5F) .... *bonaldoi*
– Terminal apophysis lacking shield; with distal apical encircling prong (2 h in Figs. 62, 69; 10 h in Fig. 74) 55
55(54) Palpus, mesal view: distal prong lightly sclerotized (Figs. 470, 471); more than 3.0 mm total length; southern Brazil (Map 4I) .... *sobradinho*
– Distal prong heavily sclerotized (Figs. 62, 74); less than 2.5 mm total length 56
56(55) Palpus, mesal view: conductor hourglass-shaped (3 h in Fig. 62); Bolivian mountains near La Paz (Map 1G) .... *cajuta*
– Conductor hidden in mesal view (Fig. 73); mountains of Cuzco, Peru to northwestern Argentina (Map 1D) .... *cochuna*

57(44) Palpus, mesal view: embolus long, curved (Figs. 222, 417, 519) 58
– Embolus short (Fig. 625) 61
58(57) Palpus, mesal view: bulb wider than long (Fig. 417); southern Brazil (Map 4F) .... *blumenau*
– Bulb slightly longer than wide (Figs. 222, 519) 59
59(58) Palpus, mesal view: embolus thin, almost

filamentous, its base not visible (Fig. 519); northern Peru (Map 5G) ..... *kuntur*

– Embolus heavier with base (Fig. 222, 230) 60

60(59) Palpus, mesal view: base of embolus covered by cymbium (Fig. 222); southern Brazil (Map 3A) ..... *botelho*

– Base of embolus exposed (Fig. 230); Paraguay, northeastern Argentina (Map 3A) ..... *uziga*

61(57) Palpus, mesal view: distal band of terminal apophysis hanging apically above bulb (Figs. 625, 626); southern Brazil, northeastern Argentina (Map 6D) ..... *strenua*

– Terminal apophysis otherwise 62

62(61) Palpus: terminal apophysis with distal apical, encircling prong (Figs. 69, 496) 63

– Terminal apophysis lacking distal encircling structure 64

63(62) Palpus: encircling structure pointed (Figs. 68, 69); northwestern Argentina (Map 1D) ..... *yungas*

– Encircling structure appearing truncate in ventral view (Fig. 496); southwestern Colombia (Map 5B) ..... *eberhardi*

64(62) Palpus, mesal view: terminal apophysis with a projecting shield, extending beyond bulb (2 h in Figs. 109, 176, 185, 1 h in Figs. 278, 301) 65

– Terminal apophysis without a projecting shield 70

65(64) Palpus, mesal view: shield projecting distally from palpus (1 h in Figs. 278, 301) 66

– Shield projecting ventrally (2–3 h in Figs. 109, 176, 185) 67

66(65) Palpus, mesal view: embolus an unusually wide hook (1 h in Fig. 278); central Venezuela (Map 3E) ..... *corocito*

– Embolus a distally narrow hook (Fig. 301); southern Brazil, northeastern Argentina (Map 1D) ..... *ramirezi*

67(65) Palpus, mesal view: embolus with a more distal almost parallel hook (2 h in Fig. 109); Amazon region (Map 1I) ..... *manicore*

– Embolus without distal hook 68

68(67) Palpus, mesal view: median apophysis distal projection within frame of bulb (Fig. 185); Mato Grosso, southern Brazil (Map 2G) ..... *bocaina*

– Median apophysis distal projection extends beyond bulb (Figs. 168, 176) 69

69(68) Palpus, mesal view: median apophysis hook with rounded tip and projecting ventrally (5 h in Fig. 176); southern Brazil (Map 2E) ..... *fundo*

– Median apophysis hook pointed and projecting toward observer (6 h in Fig. 168); southern Brazil (Map 2D) ..... *velha*

70(64) Palpus, mesal view: embolus a large curved hook (Fig. 267); Minas Gerais, Rio de Janeiro States, southeastern Brazil (Map 3B) ..... *aripeba*

– Embolus not hook-shaped (Fig. 504) or a small hook (Fig. 142) 71

71(70) Palpus, mesal view: several soft lobes above embolus (Fig. 142); southern Brazil (Map 2B) ..... *melloleitaoi*

– Never more than one lobe above embolus 72

72(71) Abdomen, dorsal view: light color with a pair of black spots posteriorly (Figs. 503, 510) 73

– Coloration otherwise 78

73(72) Palpus, mesal view: terminal apophysis covering distal half of bulb with a truncate shield (12 h in Fig. 545); Amazon region: Brazil (Map 4D) ..... *minacu*

– No such shield present 74

74(73) Palpus, mesal view: bulb with two longitudinal, distally bent columns (Fig. 594); Amazon region, Ecuador, Bolivia (Map 6A) ..... *alinahui*

– Bulb with a pointed or blunt, ventrally directed structure (Figs. 523, 636) 75

75(74) Palpus, mesal view: central truncate structure (Fig. 636); southeastern Brazil (Map 4I) ..... *itatiaia*

– Central structure pointed (Figs. 523, 632) 76

76(75) Palpus, mesal view: with terminal apophysis formed into a large spine (2 h in Fig. 523); median apophysis with large pointed overlapping spine (Fig. 523); central Colombia (Map 5G) ..... *boyaca*

– Terminal apophysis otherwise (Figs. 413, 632) 77

77(76) Palpus, mesal view: a flat curved lobe above embolus (2 h in Fig. 413); Guyana and Amazon region, Brazil (Map 4E) ..... *bovis*

– Embolus a thick, curved, structure, without lobe above (Fig. 632); southeastern Brazil (Map 2D) ..... *nonoai*

78(72) Palpus, mesal view: distal embolus needle-shaped at right angle to its base (Fig. 316); coast of Venezuela, Colombia to upper Amazon, Peru (Map 3E) ..... *semiatra*

– Embolus otherwise 79

79(78) Palpus, mesal view: center of bulb with thick straight spine; two projections on ventral side of bulb (Fig. 409); southeastern Brazil (Map 4F) ..... *castelo*

– Center of bulb and margin of bulb otherwise 80

80(79) Palpus, mesal view: a bulge below embolus (center of Fig. 55); upper Amazon: southern Peru (Map 1E) ..... *zona*

– Embolus without bulge (Fig. 362) 81

81(80) Palpus, mesal view: embolus straight with angular lobe above (Fig. 362); southern Brazil to southern Bolivia and northwestern Argentina (Map 4B) ..... *v-signata*
– Embolus curved up; median apophysis otherwise (Figs. 31, 237) 82
82(81) Palpus, mesal view: conductor with sclerotized thimble-shaped lobe (4 h in Fig. 31); upper Amazon: Brazil, Colombia, southern Peru (Map 1G) ..... *unam*
– Conductor otherwise (Figs. 237, 641) 83
83(82) Palpus, mesal view: terminal apophysis, with small spine, projects above bulb (12 h in Fig. 641); embolus spine-shaped and pointing to 2 h (Fig. 641); abdomen with white pigment spots (as in Fig. 640); southeastern Bolivia, southern Brazil to northern Argentina (Map 6E) ..... *lactea*
– Terminal apophysis otherwise; embolus straight with slight distal curve pointing to 3 h (Fig. 237); southern Brazil, northeastern Argentina (Map 3B) ..... *caballero*

Mangora acre new species
Figures 4–8; Map 1A

Holotype. Female holotype from Parque Nacional da Serra do Divisor, Acre, Brazil, 10 Mar. 1997 (L. Resende, R. Vieira) in IBSP 12444. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellowish, eye region gray; sternum, legs grayish on yellow. Abdomen: dorsum without marks; venter with ring around spinnerets and slightly gray book lung covers (as in *M. mapia,* Figs. 11, 12). Posterior eye row strongly procurved. Ocular quadrangle as long as anterior width; anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.3 diameter. Anterior median eyes 0.7 diameter apart, 0.2 from laterals. Posterior median eyes 0.3 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 2.2 mm. Carapace 0.8 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.4 high. First femur 1.0 mm, patella and tibia 1.1, metatarsus 0.8, tarsus 0.5. Second patella and tibia 0.9 mm, third 0.6, fourth 1.0.

Male from Rio Branco. Prosoma: eye region black. Sternum, coxae gray. Abdomen: dorsum with a gray posterior band; venter with gray quadrangle, black book lung covers and gray ring around spinnerets; sides with a gray patch posteriorly. Anterior median eyes projecting slightly from carapace. Posterior eye row slightly procurved. Ocular quadrangle as long as anterior width; anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.6 diameter apart, 0.6 from laterals. Posterior median eyes 0.8 diameter apart, 1.0 from laterals. Height of clypeus equals 2.0 diameters of anterior median eyes. Second, third, and fourth coxae with a median macroseta. Total length 2.1 mm. Carapace 1.1 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.6 high. First femur 1.0 mm, patella and tibia 1.0, metatarsus 0.7, tarsus 0.3. Second patella and tibia 0.8 mm, third 0.6, fourth 0.8.

Males and females have been collected together.

Variation. Total length of females 2.2 to 2.4 mm, males 1.7 to 2.1. The illustrations were made from the female holotype and male from Rio Branco.

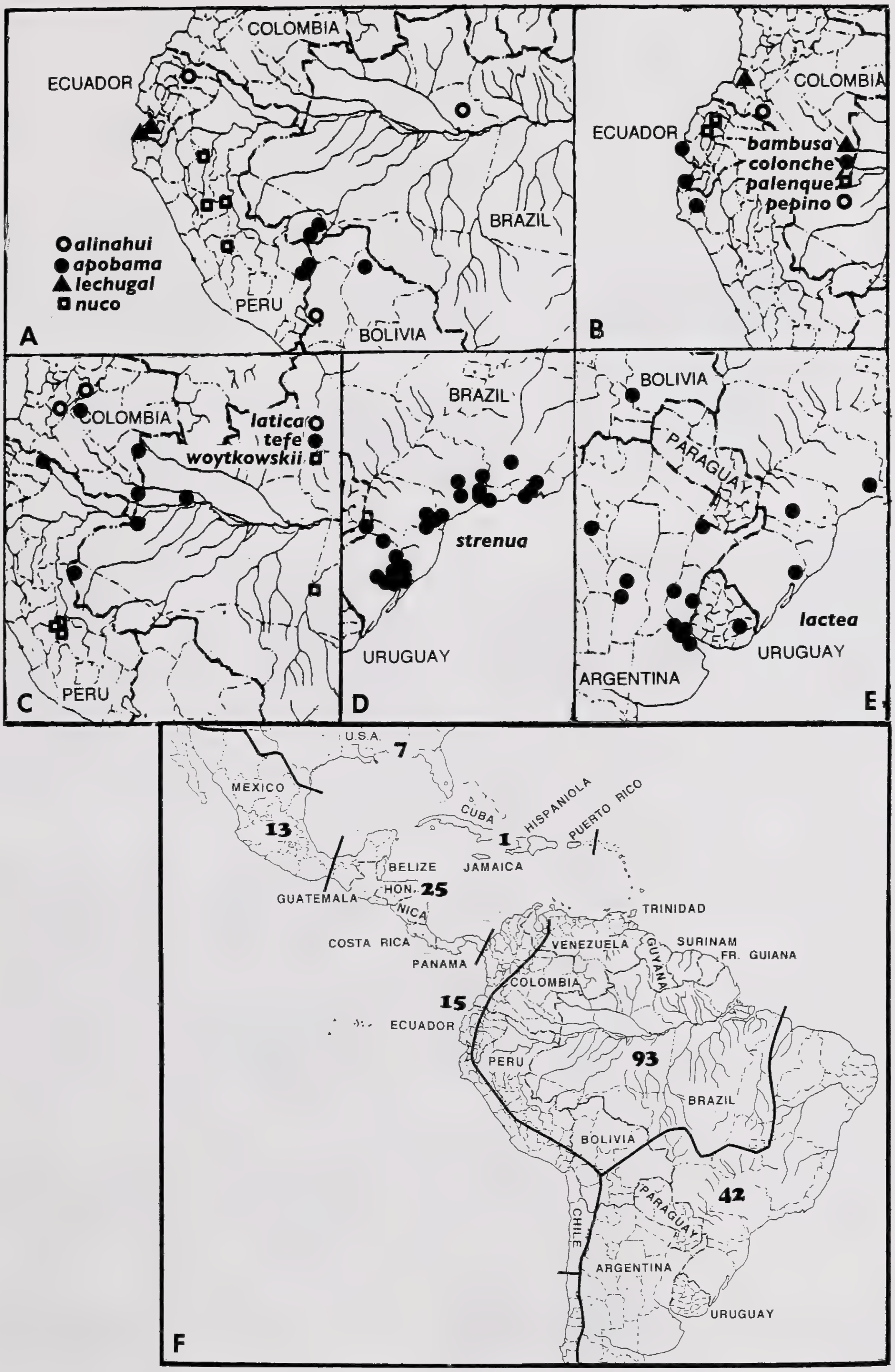
Diagnosis. The rim of the epigynum of the available specimens may have broken off. *Mangora acre* is separated from *M. mapia* by having, in posterior view of the epigynum, a light dorsal median trapezoid (6 h in Figs. 5, 7), whereas that area in *M. mapia* is dark (Fig. 10).

The male is separated by the median apophysis of the palpus (6 h in Fig. 8), which has two distal spines and a proximal lobe in *M. acre*, whereas that of *M. mapia* has only one visible spine and a proximal lobe (7 h in Figs. 13, 14). Both are separated from other species by the shape of the elongated sclerotized area of the terminal apophysis (2 h in Figs. 8, 13).

Distribution. Upper Amazon region: Colombia, Peru, western Brazil (Map 1A).

Paratypes. BRAZIL *Acre:* Parque Nacional da Serra do Divisor, 15, 24 Mar. 1997, 4♀ (L. Resende, S. Vieira, IBSP 12267, 12362).

Specimens Examined. PERU *Ucayali:* Pucallpa,



Map 6. (A–E) Distribution of *Mangora* species. (F) Approximate number of *Mangora* species known from American regions.

Bosque Nacional Alexander von Humboldt, zona de plantation 146, 30 July 1986, 1♀ (D. Silva D., MUSM). *Huánuco:* Estacion Dantas, La Molina, Quebrada Sapote, SW of Puerto Inca, 270 m, 09°38′S, 75°00′W, 18 May–1 June 1987, 5♀ (D. Silva D., MUSM). *Pasco:* Huancabamba, Quebrada Castillo, NW of Iscozacin, 345 m, 10°10′S, 75°15′W, 8–11 Sep. 1987, 5♀, 1♂ (D. Silva D., MUSM); Quebrada Chispa, 345 m, ca. 10°10′S, 75°15′W, 28 Oct., 1 Nov. 1986, 4♀ (D. Silva D., MUSM). *Cuzco:* Cashiari, 11°52′S, 72°39′W, 26 Nov. 1997, 1♀ (J. Duarez, MUSM). *Madre de Dios:* 15 km E of Puerto Maldonado, ca. 12°33′S, 69°03′W, 200 m, 9 June–10 July 1989, 2♀, 6♂ (D. Silva D., MUSM). BRAZIL *Amazonas:* Parque Nacional do Pico da Neblina, 13 Oct. 1990, 1♀ (A. A. Lise, MCP). *Acre:* Parque Nacional da Serra do Divisor, Juazeiro, 24 Nov. 1996, 1♀ (R. S. Vieira, IBSP 9046); Reserva Extrativista Humaitá, Rio Branco, 12 May 1996, 2♀, 2♂ (IBSP/SMNK staff, IBSP 15753).

Mangora mapia new species
Figures 9–14; Map 1A

Holotype. Female holotype, one male paratype from Borba, Rio Mapiá, Amazonas, Brazil, 22 Apr. 1996 (IBSP/SMNK staff), in IBSP 15977. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Carapace yellowish white, eye region black. Sternum gray. Coxae, legs yellowish white. Abdomen: dorsum with indistinct posterior gray band (Fig. 11); venter with a transverse gray rectangle, epigastric area gray, ring around spinnerets gray; sides with gray patch (Fig. 12). Posterior eye row procurved. Ocular quadrangle as long as anterior width; anterior widest. Posterior median eyes 0.7 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.6 diameter apart, 0.6 from laterals. Posterior median eyes 1.0 diameter apart, 1.0 from laterals. Height of clypeus equals 0.6 diameter of anterior median eyes. Total length 2.2 mm. Carapace 1.0 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.7 high. First femur 1.1 mm, patella and tibia 1.0, metatarsus 0.8, tarsus 0.4. Second patella and tibia 0.8 mm, third 0.6, fourth 0.9.

Male paratype. Coloration darker gray than female. Posterior eye row procurved. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 0.6 diameter of anterior medians; lateral eyes 0.4 diameter. Anterior median eyes 0.6 diameter apart, 0.2 from laterals. Posterior median eyes 0.6 diameter apart, 1.0 from laterals. Height of clypeus equals 0.6 diameter of anterior median eyes. Second patella and tibia curved and with long macrosetae including one distal macroseta. Total length 1.8 mm. Carapace 0.9 mm long, 0.8 wide in thoracic region, 0.2 wide behind lateral eyes, 0.7 high. First femur 0.9 mm, patella and tibia 0.9, metatarsus 0.7, tarsus 0.4. Second patella and tibia 0.8 mm, third 0.4, fourth 0.8.

The female holotype and male paratype were collected at the same locality on different days.

Diagnosis. The *Mangora mapia* epigynum rim may be broken off in both holotype and paratype (Figs. 9, 10). In posterior, view the dorsal, median area is black (6 h in Fig. 10), whereas that of *M. acre* has a light dorsal trapezoid (6 h in Fig. 5). Unlike most other species, the femur is as long or longer than patella and tibia.

The male has the second tibia curved with long macrosetae. The male is separated by the median apophysis of the palpus, which has two lobes (7 h in Figs. 13,

→

Figure 1. Lateral view of male *Mangora* semiatra new species.

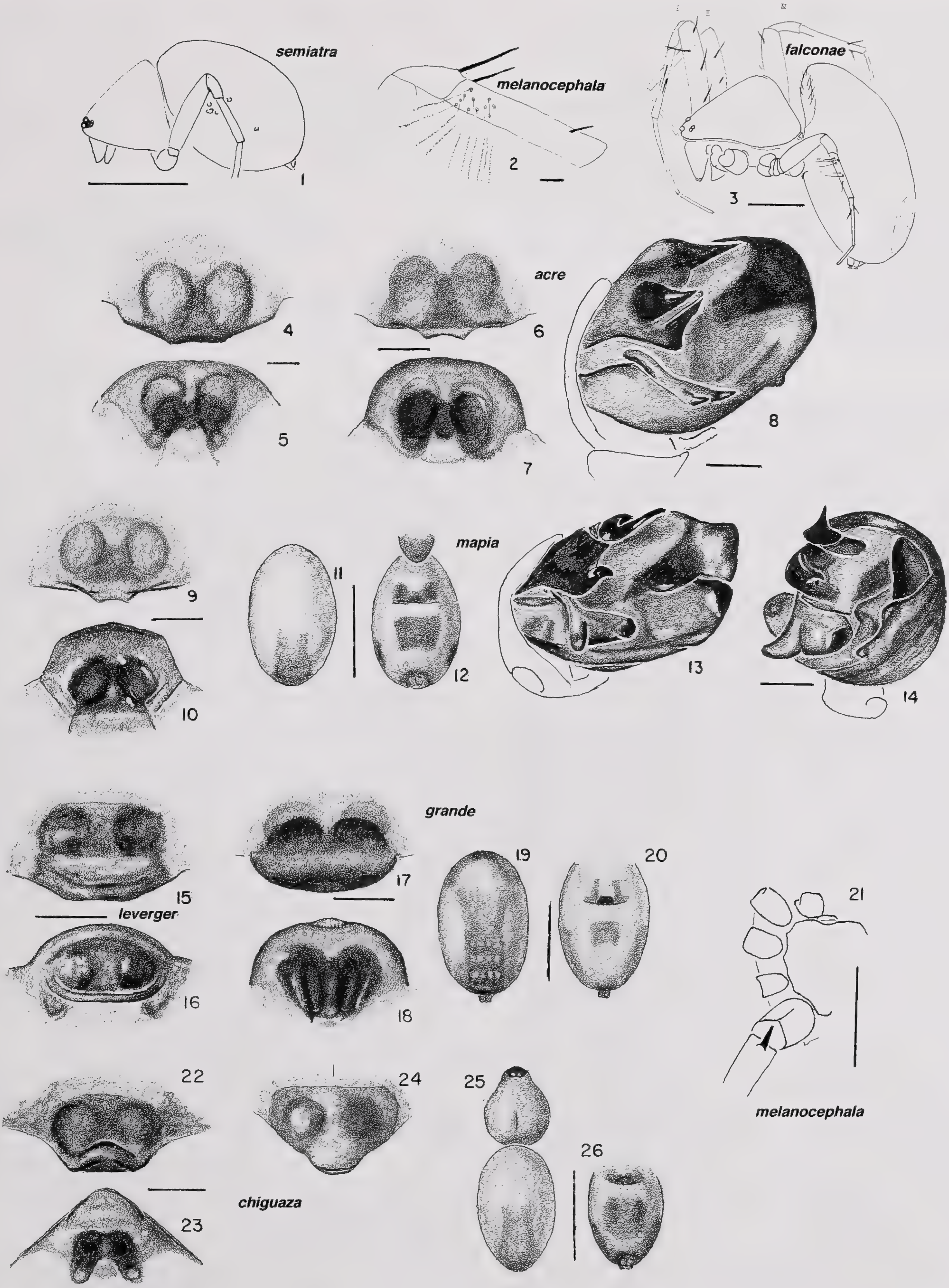
Figure 2. Left third leg of female *M. melanocephala* (Taczanowski).

Figure 3. Lateral view of female *M. falconae* Schenkel.

Figures 4–8. *M. acre* new species. 4–7, female epigynum. 4, 6, ventral; 5, 7, posterior. 8, left male palpus, mesal.

Figures 9–14. *M. mapia* new species. 9–12, female. 9, 10, epigynum. 9, ventral; 10, posterior. 11, 12, abdomen. 11, dorsal; 12, ventral. 13, 14, male palpus. 13, mesal; 14, ventral.

Figures 15, 16. *M. leverger* new species, female, epigynum. 15, ventral; 16, posterior.



Figures 17–20. *M. grande* new species, female. 17, 18, epigynum. 17, ventral; 18, posterior. 19, 20, abdomen. 19, dorsal; 20, ventral.

Figure 21. Ventral macroseta in fourth femur of male *M. melanocephala* (Taczanowski).

Figures 22–26. *M. chiguaza* new species, female. 22–24, epigynum. 22, 24, ventral; 23, posterior. 25, carapace, abdomen. 26, abdomen, ventral.

Scale lines: 1.0 mm; genitalia and Figure 2, 0.1 mm.

14), one of them pointed, and the tip of the embolus is a curved thorn, whereas the median apophysis of *M. acre* has two spines and a lobe and the embolus is a straight spine (6 h in Fig. 8). Both species can be separated from others by the elongated sclerotized area of the terminal apophysis (2 h in Figs. 8, 13).

Distribution. Amazon region (Map 1A).

Paratypes. BRAZIL *Amazonas:* Borba, Rio Mapiá, 23 Apr. 1996, 1♀ (IBSP/SMNK staff, IBSP 15973).

Specimens Examined. No other specimens have been found.

Mangora leverger new species
Figures 15, 16; Map 2B

Holotype. Female holotype from Santo Antônio de Leverger, Mato Grosso, Brazil, 29 July 1992 (A. A. Lise, A. Braul), in MCP 2396a. The specific name is a noun in apposition after the type locality.

Description. Female holotype. The coloration is as in *M. mapia* (Figs. 11, 12). Prosoma yellowish, eye region black, a black rim on thoracic area. Sternum black. Abdomen: dorsum with an anterior gray patch and a median posterior band; venter, book lungs black; venter with gray central triangular area and a black ring around spinnerets; sides with a posterior gray patch. Posterior eye row slightly procurved. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.6 diameter of anterior medians; lateral eyes 0.4 diameter. Anterior median eyes 1.2 diameters apart, 0.2 from laterals. Posterior median eyes 1.0 diameter apart, 1.2 from laterals. Height of clypeus equals 0.6 diameter of anterior median eyes. Total length 2.2 mm. Carapace 0.8 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.4 high. First femur 1.0 mm, patella and tibia 1.1, metatarsus 0.8, tarsus 0.3. Second patella and tibia 0.9 mm, third 0.6, fourth 1.1.

The male is unknown.

Diagnosis. Mangora leverger has the characteristic coloration of other small *Mangora* (Figs. 11, 12) but differs from others by the epigynum, which, in ventral view, has a transverse depression and a lip along its margin (Fig. 15), and in posterior view, also a transverse depression with a ventral and dorsal lip (Fig. 16). The similar *M. kuntur* epigynum differs by lacking the dorsal lip in posterior view (Fig. 517).

Distribution. Southern Mato Grosso, Brazil, to eastern Paraguay (Map 2B).

Specimens Examined. PARAGUAY *Alto Paraná:* Taquarazapa, ?1908–1909, 1♀ (AMNH Ac. 3721).

Mangora grande new species
Figures 17–20; Map 4A

Holotype. Female holotype from Rancho Grande, Aragua, Venezuela, 25–31 March 1945 (W. Beebe et al.), in AMNH. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Specimen yellowish white, eye region dark gray. Abdomen: dorsum with gray band containing light spots; venter with a square gray patch (Fig. 20). Posterior eye row straight. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 1.0 diameter apart, 0.2 from laterals. Posterior median eyes 0.8 diameter apart, 1.0 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 2.3 mm. Carapace 1.0 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.5 high. First femur 1.1 mm, patella and tibia 1.2, metatarsus 0.9, tarsus 0.5. Second patella and tibia 1.1 mm, third 0.6. Fourth femur 1.2 mm, patella and tibia 1.0, metatarsus 0.8, tarsus 0.4.

The male is not known.

Variation. Total length of females 2.3 to 2.5 mm. The paratype is much darker than the holotype (Figs. 19, 20) and the sternum is slightly gray, as are the distal leg articles. Figures 17, 18 were made from the holotype.

Diagnosis. Mangora grande epigynum is heavily sclerotized with a slight curvature of the rim in ventral view (Fig. 17) and is distinguished from other species by having a pair of dorsoventral grooves with dorsal openings within a pair of black depressions in posterior view (Fig. 18).

Distribution. Northern Venezuela (Map 4A).

Paratype. VENEZUELA *Aragua:* Rancho Grande Biological Station, 1♀ (C. T. Collins, AMNH).

Specimens Examined. No other specimens have been found.

Mangora chiguaza new species
Figures 22–26; Map 1B

Holotype. Female holotype and one female paratype from Chiguaza, Prov. Wakani, Morona-Santiago, Ecuador, 22 May–3 June 1977 (N. Engler) in MCZ. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Carapace yellowish, eye region black. Endites, labium gray. Sternum gray, lightest in center. Coxae yellowish; distal leg articles gray, distally darkest. Abdomen: yellowish-white, dorsum with posterior median black band (Fig. 25); venter with a central gray square, spinnerets circled with gray; sides with a posterior gray patch (Fig. 26). Posterior eye row procurved. Ocular quadrangle slightly longer than wide, anterior slightly widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.5 their diameter apart, 0.5 from laterals. Posterior median eyes 0.6 their diameter apart, 1.2 from laterals. Height of clypeus equals 2.0 diameters of anterior median eyes. Total length 2.3 mm. Carapace 1.0 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.6 high. First femur 0.9 mm, patella and tibia 1.0, metatarsus 0.7, tarsus 0.5. Second patella and tibia 0.8 mm, third 0.7. Fourth femur 1.0 mm, patella and tibia 0.9, metatarsus 0.8, tarsus 0.5.

The male is unknown.

Variation. Total length of females 2.3 to 2.6 mm. The illustrations were made from the female holotype.

Diagnosis. Mangora chiguaza epigynum is similar to that of *M. acre* (Fig. 5) but the rim is evenly curved and in posterior view has a darker median dorsal area (6 h in Fig. 23).

Distribution. Upper Amazon: Ecuador to southern Peru (Map 1B).

Specimens Examined. PERU *Madre de Dios:* Reservada Tambopata, 290 m, 12°50′S, 69°17′W, 9, 13 June 1988, 2♀ (J. Coddington, USNM).

Mangora unam new species
Figures 27–31; Map 1G

Holotype. Female holotype from Puesto de Vigil. Pakitza, Zona Reservada Manu, Madre de Dios, Peru, 11°58′S, 71°18′W, 9 Oct. 1987 (D. Silva D., J. Coddington), in USNM. The specific name is a noun in apposition after an anagram of the type locality.

Description. Female holotype. Specimen light yellow. Eye region black. Abdomen: dorsum with a posterior gray longitudinal band (Fig. 29), venter with a pair of gray patches, book lung covers gray, spinnerets gray, a black ring around spinnerets; sides of abdomen with gray patches (Fig. 30). Eyes appear small. Posterior eye row procurved. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 0.7 diameter of anterior medians; anterior lateral eyes 0.6 diameter, posterior 0.4. Anterior median eyes 0.6 diameter apart, 0.4 from laterals. Posterior median eyes 0.6 diameter apart, 1.2 from laterals. Height of clypeus equals 1.8 diameters of anterior median eyes. Total length 2.3 mm. Carapace 1.1 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.7 high. First femur 1.1 mm, patella and tibia 1.2, metatarsus 0.8, tarsus 0.4. Second patella and tibia 1.0 mm, third 0.6, fourth 1.1.

Male from Colombia. Coloration as in female. Posterior eye row procurved. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 0.5 diameter of anterior medians; anterior lateral eyes 0.3 diameter, posterior 0.2. Anterior median eyes 1.0 diameter apart, 0.3 from laterals. Posterior median eyes 1.0 diameter apart, 1.5 from laterals. Height of clypeus equals 3.0 diameters of anterior median eyes. Total length ca. 1.8 mm. Carapace 1.0 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.7

high. First femur 0.9 mm, patella and tibia 1.1, metatarsus 0.7, tarsus 0.5. Second patella and tibia 0.8 mm, third 0.6, fourth 0.8.

The males and females have been collected together.

Variation. Total length of females 2.2 to 2.3 mm. The illustrations were made from female holotype and male from Colombia.

Diagnosis. The transverse swelling of the *M. unam* epigynum (Fig. 27) is similar to that of *M. grande* (Fig. 17) but differs in posterior sculpturing (Fig. 28).

The male is separated from others by the U-shaped tongue of the conductor (central, near 5 h in Fig. 31) and by the curvature of the embolus (center of Fig. 31).

Distribution. Upper Amazon: Colombia, southern Peru, western Brazil (Map 1G).

Specimens Examined. COLOMBIA *Vaupés:* Mpo. Taraira, Serra Taraira, Caño Pintadillo, 01°01′S, 69°39′W, Mar. 2002, 11♀, 1♂ (J. Pinzón, ICNB 3336). PERU *Cuzco:* Camisea, Pagoreni, 11°42′S, 72°54′W, 465 m, 29 May 1998, 1♀ (MUSM). BRAZIL *Rondônia:* Porto Velho, 15 Apr. 1996, 4♀ (IBSP/SMNK staff, IBSP 16163). *Acre:* Reserva Extrativista de Pimenteira, Xapurí, 5–7 Apr. 1996, 1♀ (IBSP/SMNK staff, IBSP 1640).

Mangora pira new species
Figures 32–37; Map 1C

Holotype. Female holotype, two male and three immature paratypes, from Río Pira and Apaporis, 0°25′S, 70°15′W, Amazonas, Colombia, 7–16 Feb. 1989 (V. and B. Roth) in CAS. The specific name is a noun in apposition after the type locality. Pira is Spanish for pyre.

Description. Female holotype. Carapace and chelicerae yellowish, with eye region black. Labium, endites, sternum gray. Legs gray, darker distally. Abdomen: yellowish, dorsum with gray patches (Fig. 34); venter with gray square (Fig. 35). Posterior eye row procurved. Ocular quadrangle almost square, anterior slightly widest. Posterior median eyes 0.9 diameter of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes their diameter apart, 0.3 from laterals. Posterior median eyes 0.8 their diameter apart, 1.0 from laterals. Height of clypeus equals 1.2 diameters of anterior median eyes. Total length 2.3 mm. Carapace 0.9 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.6 high. First femur 0.8 mm, patella and tibia 0.8, metatarsus 0.7, tarsus 0.4. Second patella and tibia 0.8 mm, third 0.6. Fourth femur 1.0 mm, patella and tibia 1.4, metatarsus 0.7, tarsus 0.4. The fourth leg is longer than the first.

Male lighter than female. Posterior eye row procurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.6 diameter apart, 0.2 from laterals. Posterior median eyes 0.5 diameter apart, 0.8 from laterals. Height of clypeus equals 1.0 diameter of anterior median eye. Fourth femur with proximal ventral macroseta. Total length 2.2 mm. Carapace 1.3 mm long, 1.0 wide in thoracic region, 0.4 wide behind lateral eyes, 0.6 high. First femur 1.3 mm, patella and tibia 1.4, metatarsus 1.1, tarsus 0.6. Second patella and tibia 1.3 mm, third 1.1, fourth 1.3.

Males and females have been collected together.

Diagnosis. Mangora pira differs from all others by the ventrally curved epigynum with a narrow lip (Fig. 32) and, in posterior view, by the more curved rim, and two black circles with a dorsal transverse black area (Fig. 33).

The male palpus differs from all others

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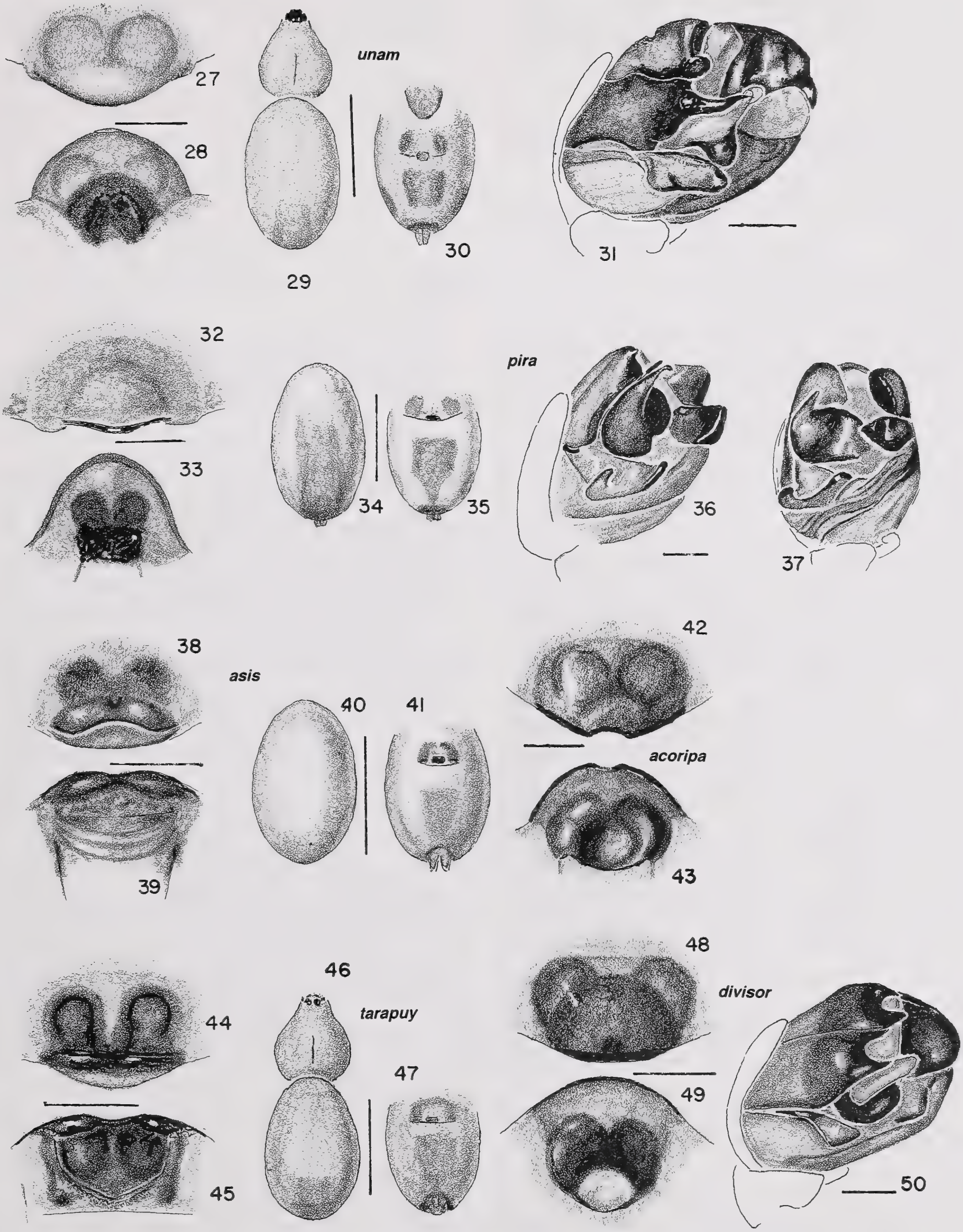
Figures 27–31. *Mangora unam* new species. 27–30, female. 27, 28, epigynum. 27, ventral; 28, posterior. 29, carapace, abdomen. 30, abdomen, ventral. 31, left male palpus, mesal.

Figures 32–37. *M. pira* new species. 32–35, female. 32, 33, epigynum. 32, ventral; 33, posterior. 34, 35, abdomen. 34, dorsal; 35, ventral. 36, 37, male palpus. 36, mesal; 37, ventral.

Figures 38–41. *M. asis* new species, female. 38, 39, epigynum. 38, ventral; 39, posterior. 40, abdomen, dorsal. 41, abdomen, ventral.



Figures 42, 43. *M. acoripa* new species, female, epigynum. 42, ventral; 43, posterior.

Figures 44–47. *M. tarapuy* new species, female. 44, 45, epigynum. 44, ventral; 45, posterior. 46, carapace, abdomen. 47, abdomen, ventral.

Figures 48–50. *M. divisor* new species. 48, 49, female, epigynum. 48, ventral; 49, posterior. 50, male palpus, mesal.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

by the central pear-shaped structure, probably the conductor, its stalk pointing distally (toward 1 h in Fig. 36), and having a dark sclerotized lobe in mesal view (on the right in the left palpus, Fig. 36).

Distribution. Upper Amazon: Colombia (Map 1C).

Specimens Examined. No other specimens were collected.

Mangora asis new species
Figures 38–41; Map 1A

Holotype. Female holotype from Río Putumayo near Puerto Asis, Putumayo, Colombia [no date] (W. Eberhard 455), in MCZ. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellowish white, eye region black and a gray median line on carapace. Sternum with gray rim. Abdomen: dorsum without marks; venter with black on epigastric area, a central gray patch and a black ring around base of spinnerets; sides with a gray line (Fig. 41). Posterior eye row procurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 1.2 diameters of anterior medians; anterior lateral eyes 0.6 diameter, posterior 0.5. Anterior median eyes 0.9 diameter apart, 0.5 from laterals. Posterior median eyes 0.3 diameter apart, 0.6 from laterals. Height of clypeus equals 1.3 diameters of anterior median eyes. Total length 2.2 mm. Carapace 0.9 mm long, 0.7 wide in thoracic region, 0.2 wide behind lateral eyes, 0.4 high. First femur 1.0 mm, patella and tibia 1.0, metatarsus 0.7, tarsus 0.5. Second patella and tibia 0.9 mm, third 0.6. Fourth femur 1.1 mm, patella and tibia 0.9.

The male is unknown. This species was collected with a male of *M. mathani*, but the smaller size of the female precludes *M. mathani* from being its male.

Variation. Total length of females 2.2 to 2.3 mm. The female from the Amazon had the posterior of the epigynum less sclerotized than the holotype. The illustrations were made from the female holotype.

Diagnosis. The *Mangora asis* epigynum differs from all others by the indented rim with swellings on each side of the rim (Fig. 38), and in posterior view by having transverse folds (Fig. 39).

Distribution. Upper Amazon: Colombia (Map 1A).

Specimens Examined. COLOMBIA *Amazonas:* Río Pira and Apaporis, 0°25′S, 70°15′W, 7–16 Feb. 1989, 1♀ (V., B. Roth, CAS).

Mangora acoripa new species
Figures 42, 43; Map 1B

Holotype. Female holotype and one female paratype from Piroca, Parque Nacional da Serra do Divisor, Acre, Brazil, 9 Nov. 1996 (R. S. Vieira) in IBSP 8973b, 8973c. The specific name is an arbitrary combination of letters as a noun in apposition.

Description. Female holotype. The coloration is as in *M. unam* and other small *Mangora* species (Figs. 29, 30). Carapace yellowish white, eye region, legs, and sternum gray. Abdomen: dorsum with a posterior black to gray band; venter with black square, sides gray posteriorly. Posterior eye row procurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.6 diameter apart, 0.2 from laterals. Posterior median eyes 1.0 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 2.2 mm. Carapace 0.8 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.6 high. First femur 0.9 mm, patella and tibia 1.0, metatarsus 0.8, tarsus 0.4. Second patella and tibia 0.9 mm, third 0.5, fourth 0.9.

The male is not known.

Illustrations. The paratype was illustrated (Figs. 42, 43).

Diagnosis. Mangora acoripa differs from all others by the epigynum with a shallow dent on its rim (Fig. 42), and in posterior view by a deep, circular depression (Fig. 43).

Distribution. Only known from Serra do Divisor, Acre State, western Brazil (Map 1B).

Specimens Examined. No other specimens were found.

Mangora tarapuy new species
Figures 44–47; Map 1C

Holotype. Female holotype Río Tarapuy, Sucumbíos, Ecuador, 23 Jan. 1983 (L. Avilés), in MECN. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma light yellowish, except sternum gray, darkest around border. Abdomen: whitish, dorsum with some posterior gray (Fig. 46); venter with a median gray patch, gray book lung covers and black circle around gray spinnerets (Fig. 47). Posterior eye row procurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; anterior lateral eyes 0.7 diameter, posterior laterals 0.5. Anterior median eyes 0.4 diameter apart, 0.3 from laterals. Posterior median eyes 0.3 their diameter apart, 0.8 from laterals. Height of clypeus equals 1.2 diameters of anterior median eyes. Total length 2.3 mm. Carapace 0.9 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.5 high. First femur 0.8 mm, patella and tibia 1.0, metatarsus 0.7, tarsus 0.4. Second patella and tibia 0.8 mm, third 0.6, fourth 0.9.

The male is not known.

Diagnosis. Mangora tarapuy epigynum is distinguished in ventral view by the light-colored rim, by the separated spermathecae and a pair of transverse swellings (Fig. 44). In posterior view there is a semicircular depression with a lip; the margin ventral to the depression has a pair of swellings (Fig. 45).

Distribution. Amazon region, Ecuador to central Amazon (Map 1C).

Specimens Examined. BRAZIL *Amazonas:* Manaus, Reserva Florestal Adolpho Ducke, 12 Mar. 1987, 1♀ (A. A. Lise, MCN 27435).

Mangora divisor new species
Figures 48–50; Map 1C

Holotype. Female holotype, male and immature male paratype from Parque Nacional da Serra do Divisor, Acre, Brazil, 15 Nov. 1996 (R. S. Vieira), in IBSP 9382. The specific name is a noun in apposition after the type locality. Divisor is Portuguese for divider.

Description. Female holotype. Coloration as in other small *Mangora* (Figs. 46, 47). Prosoma yellowish gray, eye region black. Abdomen: dorsum with posterior, longitudinal, gray band; venter with central dark gray area, black ring around spinnerets; sides with gray patches. Posterior eye row procurved. Ocular quadrangle slightly longer than wide, anterior slightly widest. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 1.0 diameter apart, 0.3 from laterals. Posterior median eyes 0.8 diameter apart, 1.0 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 2.1 mm. Carapace 0.8 mm long, 0.6 wide in thoracic region, 0.3 wide behind lateral eyes, 0.7 high. First femur 1.0 mm, patella and tibia 1.1, metatarsus 0.7, tarsus 0.3. Second patella and tibia 1.0 mm, third 0.5, fourth 0.8.

Male paratype. Coloration less distinct than that of female. Posterior eye row procurved. Ocular quadrangle as long as anterior width, slightly widest anteriorly. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 0.8 diameter apart, 0.2 from laterals. Posterior median eyes 0.6 diameter apart, 1.1 from laterals. Height of clypeus equals 2.0 diameters of anterior median eyes. Total length 1.8 mm. Carapace 1.0 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.6 high. First femur 0.9 mm, patella and tibia 0.9, metatarsus 0.8, tarsus 0.3. Second patella and tibia 0.8 mm, third 0.6, fourth 0.8.

Male and female were matched because both come from the same locality.

Diagnosis. Mangora divisor epigynum is distinguished from that of *M. acre* (Figs. 4, 5) and *M. pira* (Figs. 32, 33) by having a slightly lobed black rim with an indistinct dark spot in the center (Fig. 48). In pos-

terior view it has a large pair of dark ovals and a median dorsal white oval (Fig. 49).

The male palpus differs by having a black circular structure underneath the conductor (5 h in Fig. 50).

Distribution. Only known from Serra do Divisor, Acre, western Brazil (Map 1C).

Paratype. BRAZIL *Acre:* Parque Nacional da Serra do Divisor, Pedernal, 13 Nov. 1996, 1♂ (R. S. Vieira, IBSP 9128).

Specimens Examined. No other specimen was found.

Mangora zona new species
Figures 51–56; Map 1E

Holotype. Female holotype, 15 female, 10 male paratypes from Zona Reservada Tambopata, 290 m, 12°50′S, 69°17′W, Madre de Dios, Peru, 7–13 June, 1988 (D. Silva D.), in MCZ; one female and two male paratypes in MUSM, one male in USNM. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Carapace light orange with black eye region. Sternum, legs light orange. Abdomen: orange-white, dorsum with posterior gray patch on each side (Fig. 53); venter with a pair of gray patches, gray book lungs and black ring around spinnerets (Fig. 54). Posterior eye row procurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.8 diameter apart, 0.3 from laterals. Posterior median eyes 0.3 diameter apart, 1.0 from laterals. Height of clypeus equals 1.2 diameters of anterior median eyes. Total length 2.0 mm. Carapace 1.0 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.5 high. First femur 1.0 mm, patella and tibia 1.0, metatarsus 0.6, tarsus 0.5. Second patella and tibia 0.8 mm, third 0.6, fourth 0.8.

Male paratype. Eye region lighter than in female. Venter of abdomen with dark gray square, book lung covers and epigastric area gray. Posterior eye row procurved. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 0.7 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.5 diameter apart, 0.3 from laterals. Posterior median eyes 0.3 diameter apart, 1.0 from laterals. Height of clypeus equal to 3.0 diameters of anterior median eyes. Anterior median eyes projecting. Total length 1.9 mm. Carapace 1.0 mm long, 0.8 wide in thoracic region, 0.4 wide behind lateral eyes, 0.6 high. First femur 0.8 mm, patella and tibia 1.0, metatarsus 0.8, tarsus 0.4. Second patella and tibia 0.8 mm, third 0.6, fourth 0.8.

Males and females have been collected together.

Diagnosis. Mangora zona epigynum is distinguished by a median truncate tongue (Figs. 51, 52), whereas *M. unam* (Fig. 27) has the edge evenly rounded. It differs from that of *M. piroca* (Fig. 63) by lacking the transverse line across the base of the tongue and lacking the ventral sclerotized area (Fig. 51). In posterior view of the epigynum, *M. zona* has two black discs containing the copulatory openings (Fig. 52).

The male palpus differs from that of *M. unam* (Fig. 31) by having a small median apophysis with a distal filiform branch (6 h in Figs. 55, 56), and the distinctive shape

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Figures 51–56. *Mangora zona* new species. 51–54, female. 51, 52, epigynum. 51, ventral; 52, posterior. 53, carapace, abdomen. 54, sternum, abdomen. 55, 56, left male palpus. 55, mesal; 56, ventral.

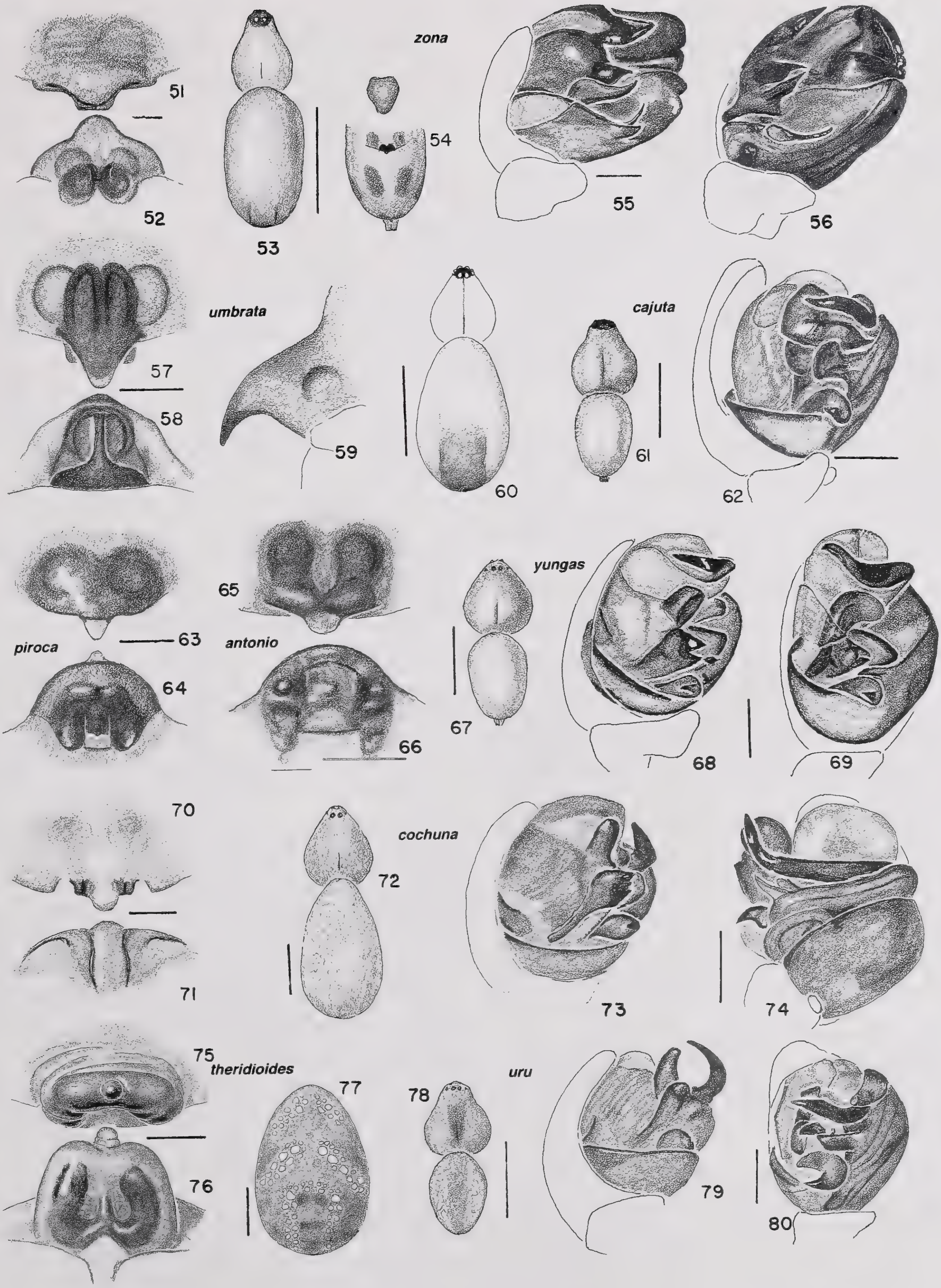
Figures 57–60. *M. umbrata* Simon, female. 57–59, epigynum. 57, ventral; 58, posterior; 59, lateral. 60, carapace, abdomen.

Figures 61, 62. *M. cajuta* new species, male. 61, carapace, abdomen. 62, palpus, mesal.

Figures 63, 64. *M. piroca* new species, female, epigynum. 63, ventral; 64, posterior.

Figures 65, 66. *M. antonio* new species, female, epigynum. 65, ventral; 66, posterior.

Figures 67–69. *M. yungas* new species, male. 67, carapace and abdomen. 68, 69, palpus. 68, mesal; 69, ventral.



Figures 70–74. *M. cochuna* new species, 70–72, female. 70, 71, epigynum. 70, ventral; 71, posterior. 72, carapace, abdomen. 73, 74, male palpus. 73, mesal; 74, ventral.

Figures 75–77. *M. theridioides* Mello-Leitão, female. 75, 76, epigynum. 75, ventral; 76, posterior. 77, abdomen, dorsal.

Figures 78–80. *M. uru* new species, male. 78, carapace, abdomen. 79, 80, male palpus. 79, mesal; 80, ventral.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

of the heavily sclerotized embolus with a bulge below the tip (center of Fig. 55).

Distribution. Upper Amazon region: southern Peru (Map 1E).

Paratypes. PERU *Madre de Dios:* Zona Reservada Tambopata, 290 m, 12°50′S, 69°17′W, 30 July 1988, 2♀, 1♂ (D. Silva D., MUSM).

Specimens Examined. No other specimens have been collected.

Mangora umbrata Simon
Figures 57–60; Map 1G

Mangora umbrata Simon, 1897: 478. Female holotype from Pebas, Peru in the MNHN, examined. Platnick, 2006.

Note. No description was made in 1971 when I borrowed the specimen.

Description. The coloration is as in other small species (Fig. 60). Total length 2.3 mm.

The male is unknown.

Diagnosis. Mangora umbrata epigynum is separated from others by having the rim with a projecting tongue (Figs. 57, 59) and a pair of duct loops with the spermathecae visible laterally (Fig. 57); in posterior view the septum is an upside-down T-shape (Fig. 58).

Distribution. Upper Amazon: northeastern Peru (Map 1G).

Specimens Examined. No other specimens were found.

Mangora cajuta new species
Figures 61, 62; Map 1G

Holotype. Male holotype, one male paratype from Circuata Cajuta, Yungas, 2,400 m, La Paz, Bolivia, 3–7 Dec. 1984 (L. E. Peña), in AMNH. The specific name is a noun in apposition after the type locality.

Description. Male holotype. Prosoma orange, eye region black. Abdomen: lighter orange without marks (Fig. 61), spinnerets gray. Posterior eye row straight. Ocular quadrangle slightly wider than long, rectangular. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 1.5 diameters apart, 1.0 from laterals. Posterior median eyes 1.0 diameter apart, 1.0 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Fourth femur with ventral, proximal macroseta. Total length 2.2 mm. Carapace 1.2 mm long, 1.0 wide in thoracic region, 0.3 wide behind lateral eyes, 0.8 high. First femur 1.3 mm, patella and tibia 1.5, metatarsus 1.1, tarsus 0.7. Second patella and tibia 1.3 mm, third 0.7, fourth 1.3.

The female is not known.

Diagnosis. Mangora cajuta male palpus is separated from others by having a prong surrounding the tip of the terminal apophysis (2 h in Fig. 62) and from *M. yungas* (Fig. 68) by having the conductor broadly attached to the tegulum (4 h in Fig. 62).

Distribution. Bolivian mountains near La Paz (Map 1G).

Specimens Examined. No other specimens have been found.

Mangora piroca new species
Figures 63, 64; Map 1G

Holotype. Female holotype and a female paratype from Piroca, Parque Nacional da Serra do Divisor, Acre, Brazil, 9 Nov. 1996 (R. S. Vieira) in IBSP 8973, 8973a. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Colored as other small species (Figs. 34, 35). Prosoma yellowish white, eye region, sternum, legs gray. Abdomen: dorsum with median posterior dorsal band; venter with gray square; sides gray. Posterior eye row procurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.6. Anterior median eyes 1.0 diameter apart, 0.3 from laterals. Posterior median eyes 0.7 diameter apart, 1.3 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 2.2 mm. Carapace 0.8 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.5 high. First femur 0.9 mm, patella and tibia 0.9, metatarsus 0.7, tarsus 0.4. Second patella and tibia 0.8 mm, third 0.5, fourth 0.8.

The male is not known.

Diagnosis. Mangora piroca differs from

M. antonio (Figs. 65, 66) by having a narrower tongue extending from the epigynum (Fig. 63) and, in posterior view, a more delineated posterior, median light rectangle (Fig. 64).

Distribution. Only known from Serra do Divisor, Acre, western Brazil (Map 1G).

Specimens Examined. No other specimens have been found.

Mangora antonio new species
Figures 65, 66; Map 1D

Holotype. Female holotype and one female paratype from Santo Antônio de Leverger, Mato Grosso, Brazil, 19 July 1992 (A. A. Lise, A. Braul) in MCP 2396. The specific name is a noun in apposition after the name of the type locality.

Description. Female holotype. Coloration as other small species (Figs. 34, 35). Prosoma yellowish, eye region black, a thin black line along carapace edge. Abdomen: dorsum with anterior gray patch, a posterior gray band; venter with gray square, black book lung plates and black ring around spinnerets; sides with gray patches. Posterior eye row procurved. Ocular quadrangle longer than wide, anterior slightly widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.8 diameter apart, 0.5 from laterals. Posterior median eyes 0.9 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 2.5 mm. Carapace 1.0 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.6 high. First femur 1.0 mm, patella and tibia 1.0, metatarsus 0.7, tarsus 0.4. Second patella and tibia 0.9 mm, third 0.6, fourth 1.0.

The male is unknown.

Diagnosis. Mangora antonio differs from *M. piroca* (Figs. 63, 64) by having a wider tongue extending from the epigynum (Fig. 65) and, in posterior view, a wider, less distinct light area (Fig. 66).

Distribution. Mato Grosso, Brazil (Map 1D).

Specimens Examined. No other specimens have been found.

Mangora yungas new species
Figures 67–69; Map 1D

Holotype. Male holotype with two male paratypes from El Rey National Park, 950 m, Pozo Verde Trail, km 5, Salta Prov., Argentina, 5–15 Dec. 1987 (S. and J. Peck), in AMNH. The specific name is a noun in apposition after the forest habitat.

Description. Male holotype. Prosoma orange. Abdomen: lighter orange (Fig. 67). Posterior eye row slightly recurved. Ocular quadrangle square. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 1.0 diameter apart, 1.0 from laterals. Posterior median eyes 1.0 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Fourth femur with one proximal, ventral macroseta and in line, two distal macrosetae. Total length 2.3 mm. Carapace 1.1 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.6 high. First femur 1.2 mm, patella and tibia 1.5, metatarsus 0.9, tarsus 0.5. Second patella and tibia 1.3 mm, third 0.7, fourth 1.1.

The female is not known.

Diagnosis. Males have a distinct ventral macroseta at the proximal end of the fourth femur (as in *M. melanocephala*, Fig. 21) and are distinguished from others, except *M. cajuta*, by the large distal prong surrounding the tip of the palpus (Figs. 68, 69). It differs from *M. cajuta* (Fig. 62) by the shape of the embolus (center toward 5 h in Fig. 68).

Natural History. Specimens were collected by sweeping, and in a Malaise trap in subtropical humid forest at El Ucumar.

Distribution. Northwestern Argentina (Map 1D).

Specimens Examined. ARGENTINA *Salta:* 45 km N Salta, 1,550 m, El Ucumar, 2–30 Dec. 1987, 4♂ (S. and J. Peck, AMNH).

Mangora cochuna new species
Figures 70–74; Map 1D

Holotype. Male holotype from Cochuna, Tucumán, Argentina, 2 July 1995 (M. Ramírez, P. Goloboff) in MACN. The species name is a noun in apposition after the type locality.

Description. Female from Tucumán. Prosoma yellowish. Abdomen: dorsum with white pigment spots, except for a dorsal, posterior longitudinal rectangle (Fig. 72); venter orange-white; spinnerets gray; sides with white pigment spots. Posterior eye row straight. Ocular quadrangle longer than wide, posterior widest. Posterior median eyes 1.3 diameters of anterior medians; laterals 1.0 diameter. Anterior median eyes 1.2 diameters apart, 1.2 from laterals. Posterior median eyes 1.1 diameters apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 3.4 mm. Carapace 1.2 mm long, 1.0 wide in thoracic region, 0.4 wide behind lateral eyes, 0.7 high. First femur 1.5 mm, patella and tibia 1.7, metatarsus 1.1, tarsus 0.4. Second patella and tibia 1.6 mm, third 0.8, fourth 1.6.

Male holotype. Prosoma yellowish. Abdomen: dorsum white, posterior with pair of faint gray lines; venter orange-white; spinnerets yellow. Posterior eye row slightly recurved. Ocular quadrangle wider than long, posterior widest. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 1.2 diameters apart, 1.0 from laterals. Posterior median eyes 1.0 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. A weak macroseta on venter of proximal end of fourth femur. Total length 2.1 mm. Carapace 1.0 mm long, 0.9 wide in thoracic region, 0.4 wide behind lateral eyes, 0.6 high. First femur 1.3 mm, patella and tibia 1.6, metatarsus 1.1, tarsus 0.6. Second patella and tibia 1.3 mm, third 0.7, fourth 1.2.

Males and females have been collected together.

Variation. Total length of females 3.0 to 3.4 mm, males 2.0 to 2.4. The palpus is lightly sclerotized and difficult to study. The transparent terminal apophysis bubble (1 h in Fig. 74) resembles that of some *Metazygia* species. However specimens of *M. cochuna* have macrosetae on the third tibia as in other *Mangora*.

Diagnosis. Unlike the genitalia of other small and medium-sized *Mangora, M. cochuna* genitalia are only weakly sclerotized; the epigynum is recognizable by the small tongue, widened near its base and flanked by notches (Fig. 70). In posterior view it has a narrow, parallel-sided, median plate and a pair of curved lateral plates (Fig. 71).

The weakly sclerotized male palpus, which has a distal prong, as in *M. cajuta* (Fig. 62) and *M. yungas* (Figs. 68, 69), differs by having an embolus that appears to bear several denticles on its tip (3 h in Fig. 73).

Natural History. Specimens were collected at night in cloud forest at Cuzco.

Distribution. Mountains from Cuzco, Peru, to northern Argentina (Map 1D).

Specimens Examined. PERU *Cuzco:* Parque Nacional Manu, carretera Paucartambo-Pilcopata, nr. Buenos Aires, 2,370 m, 15–16 Feb. 1990, 1♀, 1♂ (D. Silva, MUSM); Wiñayhuaina, ca. 13°07′S, 72°34′W, 2,700–3,100 m, 8–11 Feb. 1990, 2♀, 5♂ (D. Silva D., MUSM). ARGENTINA *Jujuy:* Parque Nacional Calilegua, 23–24, Sep. 1995, 1♂ (M. J. Ramírez, MACN). *Tucumán:* Horco Molle, Nov. 1960, 2♀ (M. E. Galiano, MACN 5332).

Mangora theridioides Mello-Leitão
Figures 75–77; Map 2A

Mangora theridioides Mello-Leitão, 1948: 166, fig. 9, ♀. Female holotype from Takama River [05°34′S, 57°55′W], Guyana (Cattle Trail Survey), in BMNH, examined. Platnick, 2006.

Note. It is not possible to recognize the species by using Mello-Leitão's illustration of the epigynum.

Description. Female holotype. Prosoma orange yellow. Abdomen: dorsum with white pigment spots and dusky marks (Fig. 77); venter with a pair of white longitudinal lines, each line with a spur continuing up the sides. Posterior median eyes 1.0 diameter of anterior medians; anterior lateral eyes 0.8 diameter, posterior 0.6. Anterior median eyes 0.5 diameter apart, 0.5 from laterals. Posterior median eyes 0.6 diameter apart, 0.8 from laterals. Total length 4.7 mm. Carapace 1.8 mm long, 1.4 wide in thoracic region. First femur 2.2

mm, patella and tibia 2.5, metatarsus 2.0, tarsus 0.9. Second patella and tibia 2.3 mm, third 1.3, fourth 2.1.

The male is not known.

Diagnosis. Mangora theridioides epigynum projects ventrally (Fig. 75) and, unlike other species, in posterior view has a pair of grooves leading to a pair of openings separated and surrounded by swollen areas (Fig. 76) resembling that of *M. grande* (Fig. 18).

Distribution. Guyana (Map 2A).

Specimens Examined. No other specimens have been found.

Mangora uru new species
Figures 78–80; Map 1I

Holotype. Male holotype and one male paratype from Urubamba River, below Machu Picchu, ca. 2,000 m, Cuzco, Peru, 21 Feb. 1965 (H. Levi) in MCZ. The specific name is a noun in apposition, an arbitrary combination of letters.

Description. Male holotype. Prosoma yellow-white, carapace with a gray, median band (Fig. 78). Abdomen: dorsum lighter with a pair of bands containing white pigment spots (Fig. 78); no marks ventrally, spinnerets gray. Posterior eye row straight. Ocular quadrangle square. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.7 diameters. Anterior median eyes 1.0 diameter apart, 1.0 from laterals. Posterior median eyes 1.0 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Fourth femur with proximal, ventral macroseta. Total length 2.1 mm. Carapace 1.2 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.6 high. First femur 1.6 mm, patella and tibia 1.6, metatarsus 1.1, tarsus 0.7. Second patella and tibia 1.3 mm, third 0.8, fourth 1.2.

The female is not known.

Diagnosis. Mangora uru palpus differs from those of *M. cochuna* (Figs. 73, 74), *M. yungas* (Figs. 68, 69), and *M. cajuta* (Fig. 62) in the shape of the short, distal prong (Figs. 79, 80).

Natural History. The type was collected in forest vegetation.

Distribution. Upper Amazon: Cuzco, Peru (Map 1I).

Specimens Examined. No other specimens have been collected.

Mangora sturmi new species
Figures 81–84; Map 1B

Holotype. Female holotype from Amacayacu, Parque Nacional, ca. 48 km NW of Leticia, 03°48′S, 70°16′W, Amazonas, Colombia, 3 Oct. 1985 (H. Sturm), in MCZ. The species is named after the collector, entomologist Prof. Helmut Sturm.

Description. Female holotype [damaged and without legs]. Carapace gray-brown, cephalic region lighter. Labium, endites, sternum gray-brown. Abdomen: dorsum light gray with some gray marks (Figs. 83, 84). Posterior eye row procurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 0.9 diameter of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes their diameter apart, 0.6 from laterals. Posterior median eyes their diameter apart, 1.0 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 2.2 mm. Carapace 1.0 mm long, 0.7 wide in thoracic region, 0.4 wide behind lateral eyes, 0.5 high. [Legs lost.]

The male is unknown.

Diagnosis. Mangora sturmi epigynum in ventral view differs from others by having a transverse swelling and a thin rim, a projecting lip with a median notch (Fig. 81); it differs from others by being square in posterior view, with a dorsolateral ridge (Fig. 82).

Distribution. Upper Amazon: southern Colombia (Map 1B).

Specimens Examined. No other specimens have been collected.

Mangora taraira new species
Figures 85, 86; Map 1B

Holotype. Female holotype from Municipio Taraira, Serrano Taraira, Caño Pintadillo, 01°01′S, 69°39′W, Vaupés, Colombia, Mar. 2002 (J. Pinzón), in ICNB AR-3336. The specific name is a noun in opposition after the type locality.

Description. Female holotype [dam-

aged, dorsoventrally flattened]. Coloration as other small species (Figs. 89, 90). Prosoma light yellowish, legs light gray, sternum gray. Abdomen: dorsum yellowish white, with black ring around spinnerets; venter with central gray square. Posterior eye row straight. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 0.8 diameter apart, 0.4 from laterals. Posterior median eyes 0.6 diameter apart, 1.3 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 2.0 mm. Carapace 0.8 mm long. First femur 0.9 mm, patella and tibia 0.9, metatarsus 0.7, tarsus 0.3. Second patella and tibia 0.8 mm, third 0.6. Fourth femur 1.0 mm, patella and tibia 0.9, metatarsus 0.8, tarsus 0.3.

The male is not known.

Diagnosis. Mangora taraira epigynum differs from that of other small species with similar coloration by the large, adjacent, indistinctly outlined spermathecae visible in ventral view, and the almost straight posterior rim, with a short, thin lip (Fig. 85). In posterior view it has dark openings, separated by a small dorsoventral light ridge (Fig. 86).

Distribution. Upper Amazon: southeastern Colombia (Map 1B).

Specimens Examined. COLOMBIA *Vaupés:* Lago Taraira, Estación Biológica Caparú, 1°04′S, 69°31′W, May 2002, 1♀ (J. Pinzón, A. Schogal, ICNB).

Mangora vaupes new species
Figures 87–90; Map 1C

Holotype. Female holotype from Lago Taraira, Estación Biológica Caparú, 01°04′S, 69°31′W, Vaupés, Colombia, May 2002 (J. Pinzón, A. Schogal), in ICNB AR-3328. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellowish, eye region black; endites, labium, sternum black; legs with indistinct longitudinal lines, distal articles darker. Abdomen: dorsum with posterior, longitudinal gray band and black rings around spinnerets (Fig. 89); venter with central quadrangular dark gray patch (Fig. 90); sides with posterior gray patches, spinnerets black. Posterior eye row procurved. Ocular quadrangle slightly longer than wide, anterior widest. Posterior median eyes 0.7 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.5 diameter apart, 0.2 from laterals. Posterior median eyes 0.8 diameter apart, 1.0 from laterals. Height of clypeus equals 0.7 diameter of anterior median eyes. Total length 2.1 mm. Carapace 0.8 mm long, 0.6 wide in thoracic region, 0.3 wide behind lateral eyes, 0.7 high. First femur 1.0 mm, patella and tibia 1.0, metatarsus 0.7, tarsus 0.4. Second patella and tibia 0.7 mm, third 0.5, fourth 0.8.

The male is not known.

Diagnosis. Mangora vaupes epigynum has a wide, lobed, tongue-shaped rim (Fig. 87). *Mangora vaupes* differs from others in posterior view by having two overlapping black discs (Fig. 88).

Natural History. The holotype was found in tierra firma forest.

Distribution. Upper Amazon: southeastern Colombia (Map 1C).

Specimens Examined. No other specimens have been found.

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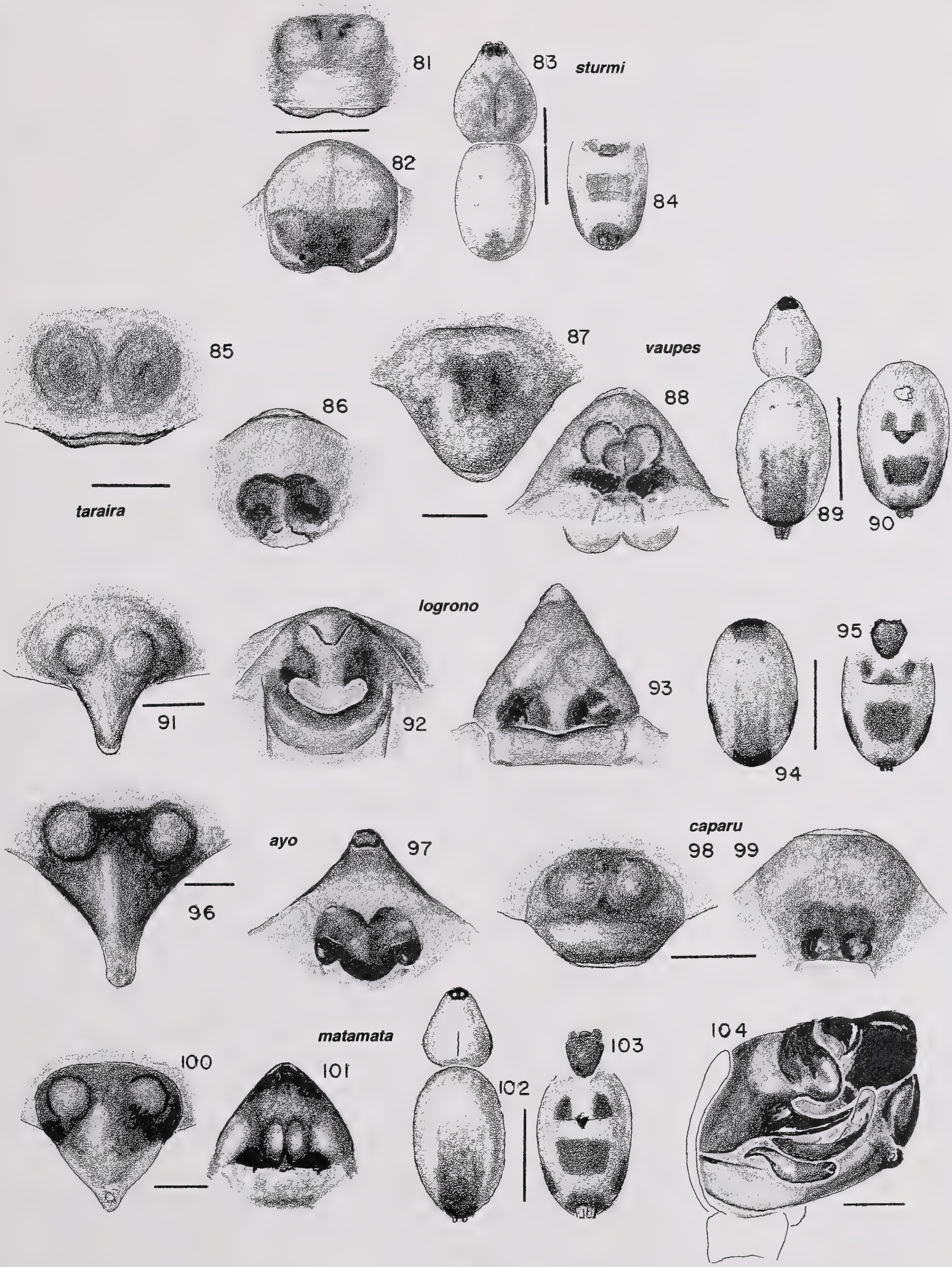
Figures 81–84. *Mangora sturmi* new species, female. 81, 82, epigynum. 81, ventral; 82, posterior. 83, carapace, abdomen. 84, abdomen, ventral.

Figures 85, 86. *M. taraira* new species, female epigynum. 85, ventral; 86, posterior.

Figures 87–90. *M. vaupes* new species, female. 87, 88, epigynum. 87, ventral; 88, posterior. 89, carapace, abdomen. 90, abdomen, ventral.

Figures 91–95. *M. logrono* new species, female. 91–93, epigynum. 91, ventral; 92, 93, posterior. 94, abdomen, dorsal. 95, sternum, abdomen, ventral.

Figures 96, 97. *M. ayo* new species, female epigynum. 96, ventral; 97, posterior.



Figures 98, 99. *M. caparu* new species, female epigynum. 98, ventral. 99, posterior.

Figures 100–104. *M. matamata* new species. 100–103, female. 100, 101, epigynum. 100, ventral; 101, posterior. 102, carapace, abdomen. 103, sternum, abdomen. 104, left male palpus, mesal.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

Mangora logrono new species
Figures 91–95; Map 1E

Holotype. Female holotype from "Yapitya" along main trail from Logroño to Yaupi, W slope of Cordillera del Cutucú, ca. 02°38′S, 78°30′W, Morona-Santiago, Ecuador, 1 July 1984 (R. M. Peck), in ANSP. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma light orange, eye region black; endites, labium, sternum black, legs with gray. Abdomen: dorsum with an anterior black transverse mark, a posterior longitudinal black to gray band and black rings around spinnerets (Fig. 94); venter with black book lung covers; epigynal region, with a central quadrangular dark gray patch; black ring around spinnerets (Fig. 95); sides with posterior black patches, spinnerets black. Posterior eye row straight. Ocular quadrangle square. Posterior median eyes 1.1 diameters of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 1.0 diameter apart, 0.8 from laterals. Posterior median eyes 0.9 diameter apart, 1.3 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 2.3 mm. Carapace 0.9 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.5 high. First femur 0.9 mm, patella and tibia 1.1, metatarsus 0.8, tarsus 0.5. Second patella and tibia [lost], third 0.7, fourth [lost].

The male is not known.

Diagnosis. Mangora logrono epigynum differs from that of *M. ikuruwa* (Figs. 116, 117) by having, in posterior view, a transverse, wide, oval depression (Fig. 92), which can be seen, though with difficulty, by slightly turning the epigynum when viewed (Fig. 92, 93).

Natural History. The specimen was found in "tall, humid, primary forest on flat area along ridge top in large pristine remote area".

Distribution. Southeastern Ecuador (Map 1E).

Specimens Examined. No other specimens have been found.

Mangora ayo new species
Figures 96, 97; Map 1A

Holotype. Female holotype and two female paratypes from La Mathani, Quebradón, El Ayo, Amazonas, Colombia, 01°35′S, 69°31′W, May 2002 (J. Pinzón, A. Schogal), in ICNB AR-3338. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Coloration as in other small species (Figs. 94, 95). Prosoma yellowish, eye region black; endites, labium, sternum black; legs with indistinct longitudinal lines, distal articles darker. Abdomen: dorsum with posterior, longitudinal, gray band and black rings around spinnerets; venter with central dark gray patch; sides with posterior gray patches, spinnerets black. Posterior eye row procurved. Ocular quadrangle slightly wider than long, anterior widest. Posterior median eyes 0.6 diameter of anterior medians; lateral eyes 0.4 diameter. Anterior median eyes 0.3 diameter apart, 0.2 from laterals. Posterior median eyes 0.8 diameter apart, 0.3 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 1.9 mm. Carapace 0.9 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.4 high. First femur 0.8 mm, patella and tibia 0.9, metatarsus 0.8, tarsus 0.4. Second patella and tibia 0.8 mm, third 0.4, fourth 0.8.

The male is not known.

Variation. Total length of females 1.7 to 2.1 mm.

Diagnosis. Mangora ayo epigynum differs from that of *M. matamata* (Fig. 100) and *M. logrono* (Fig. 91) by having the spermathecae more than their diameter apart (Fig. 96), and by a pair of shallow depressions in posterior view (Fig. 97).

Distribution. Upper Amazon: southeastern Colombia (Map 1A).

Specimens Examined. COLOMBIA *Vaupés:* Mpo. Taraira, Serr. Taraira, Caño Pintadillo, 01°01′S, 69°39′W, Mar. 2002, 4♀ (J. Pinzón, ICNB).

Mangora caparu new species
Figures 98, 99; Map 1E

Holotype. Female holotype and one female paratype from Lago Taraira, Estación Biológica Caparú,

01°04′S, 69°31′W, Vaupés, Colombia, May 2002 (J. Pinzón, A. Schogal), in ICNB. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Coloration as in other small species (Figs. 94, 95). Prosoma yellowish, eye region black; endites, labium, sternum black; legs with indistinct longitudinal lines, distal articles darker. Abdomen: dorsum with posterior, longitudinal, gray band and black rings around spinnerets; venter with central square dark black patch; sides with posterior gray patches, spinnerets black. Posterior eye row slightly procurved. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 0.7 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.6 diameter apart, 0.3 from laterals. Posterior median eyes 0.9 diameter apart, 1.3 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 2.4 mm. Carapace 0.9 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.6 high. First femur 0.9 mm, patella and tibia 0.9, metatarsus 0.7, tarsus 0.5. Second patella and tibia 0.8 mm, third 0.6. Fourth femur 1.0 mm, patella and tibia 0.8, metatarsus 0.8, tarsus 0.4.

The male is not known.

Variation. Total length of females 2.0 to 2.4 mm.

Diagnosis. Mangora caparu epigynum (Figs. 98, 99) differs from that of *M. taraira* (Figs. 85, 86) by having the spermathecae smaller, further from the edge, and anterior to a transverse swelling in a slightly extended, wide lobe (Fig. 98); and differs from all similar species in posterior view by the openings placed far dorsally in a pair of small circular depressions (Fig. 99).

Natural History. Specimens have been collected from tierra firma forest, forest that does not get flooded.

Distribution. Upper Amazon: southeastern Colombia (Map 1E).

Paratypes. COLOMBIA *Vaupés:* Lago Taraira, Estación Biológica Caparú, 01°04′S, 69°31′W, 200 m, Sep. 2002—May 2003, 1♀, 4 imm. (L. Bonavides, ICNB AR-3326).

Specimens Examined. COLOMBIA *Amazonas:* La Mathani, Quebradón El Ayo, 01°35′S, 69°31′W, May 2002, 2♀ (J. Pinzón, ICNB).

Mangora matamata new species
Figures 100–104; Map 1I

Holotype. Female holotype, two female and one male paratype from Parque Nacional Natural Amacayacu, Laguna Matamata, 03°41′S, 70°15′W, Amazonas, Colombia, Nov. 2001, in ICNB AR-3344a. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma light orange, eye region black; endites, labium, sternum black; legs gray. Abdomen: dorsum with posterior longitudinal gray band (Fig. 102); venter with central dark gray area, black ring around spinnerets, book lung covers black (Fig. 103). Sides with posterior gray patches. Posterior eye row strongly procurved. Ocular quadrangle slightly longer than wide, anterior slightly widest. Posterior median eyes 0.9 diameter of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 0.9 diameter apart, 0.2 from laterals. Posterior median eyes 1.0 diameter apart, 1.2 from laterals. Height of clypeus equals 2.0 diameters of anterior median eyes. Total length 2.3 mm. Carapace 0.8 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.5 high. First femur 0.9 mm, patella and tibia 0.9, metatarsus 0.7, tarsus [lost]. Second patella and tibia 0.8 mm, third 0.5, fourth 0.8.

Male paratype. Coloration as in female. Posterior eye row strongly procurved. Ocular quadrangle slightly longer than wide, anterior slightly widest. Posterior median eyes 0.9 diameter of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 0.9 diameter apart, 0.2 from laterals. Posterior median eyes 1.0 diameter apart, 1.2 from laterals. Height of clypeus equals 2.0 diameters of anterior median eyes. Total length 2.3 mm. Carapace 0.8 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.5 high. First femur 0.9 mm, patella and tibia 0.9, metatarsus 0.7, tarsus [lost]. Second patella and tibia 0.8 mm, third 0.5, fourth 0.8.

Males and females have been collected together.

Diagnosis. *Mangora matamata* epigynum (Fig. 100) is shorter and more pointed than that of *M. ayo* (Fig. 96). It differs from *M. ayo* in posterior view by a pair of narrow, oval, dorsoventral depressions (Fig. 101).

The male differs from others that have a sclerotized terminal apophysis, such as *M. divisor* (2 h in Fig. 50), by the long, gracefully curved embolus (Fig. 104).

Distribution. Upper Amazon: southeastern Colombia (Map 1I).

Specimens Examined. No other specimens have been collected.

Mangora manicore new species
Figures 105–109; Map 1I

Holotype. Female holotype and male paratype from Barreira do Matupiri, Manicoré, Amazonas, Brazil, 18 Apr. 1996 (IBSP/SMNK staff), in IBSP 15452, 15477. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Carapace yellow, eye region black. Sternum black. Legs gray, darker ventrally. Abdomen: dorsum marked with a posterior longitudinal band (Fig. 107); venter with gray square, gray book lung covers, and gray patches on each side (Fig. 108). Posterior eye row procurved. Ocular quadrangle slightly longer than wide, anterior widest. Posterior median eyes 0.5 diameter of anterior medians; lateral eyes 0.4 diameter. Anterior median eyes 0.4 diameter apart, 0.2 from laterals. Posterior median eyes 1.0 diameter apart, 1.0 from laterals. Height of clypeus equals 0.6 diameter of anterior median eyes. Total length 2.1 mm. Carapace 1.0 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.6 high. First femur 1.1 mm, patella and tibia 1.1, metatarsus 0.8, tarsus 0.3. Second patella and tibia 0.9 mm, third 0.7, fourth [lost].

Male paratype. Coloration as in female. Posterior eye row procurved. Ocular quadrangle slightly longer than wide, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.4 diameter. Anterior median eyes 1.0 diameter apart, 0.2 from laterals. Posterior median eyes 0.5 diameter apart, 0.5 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Coxae 2, 3, 4 each with a short ventral macroseta. Palpal tibia with two dorsal macrosetae (Fig. 109). Second tibia swollen and with a posterior macroseta as long as tibia. Total length 2.1 mm. Carapace 1.0 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.7 high. First femur 1.0 mm, patella and tibia 1.0, metatarsus 0.7, tarsus 0.3. Second patella and tibia 0.8 mm, third 0.5, fourth 0.9.

Males and females have been collected together.

Diagnosis. The ventral view of the *M. manicore* epigynum has a short, small tongue and widely separated spermathecae (Fig. 105); in posterior view, it differs from all other species by having five dorsoventral swollen ridges (Fig. 106).

Males have a distinct macroseta on the venter of the proximal end of the fourth femur. The palpus, unlike other species has the median apophysis tipped by a curved spine (5 h in Fig. 109). The curved embolus has a similarly shaped, larger

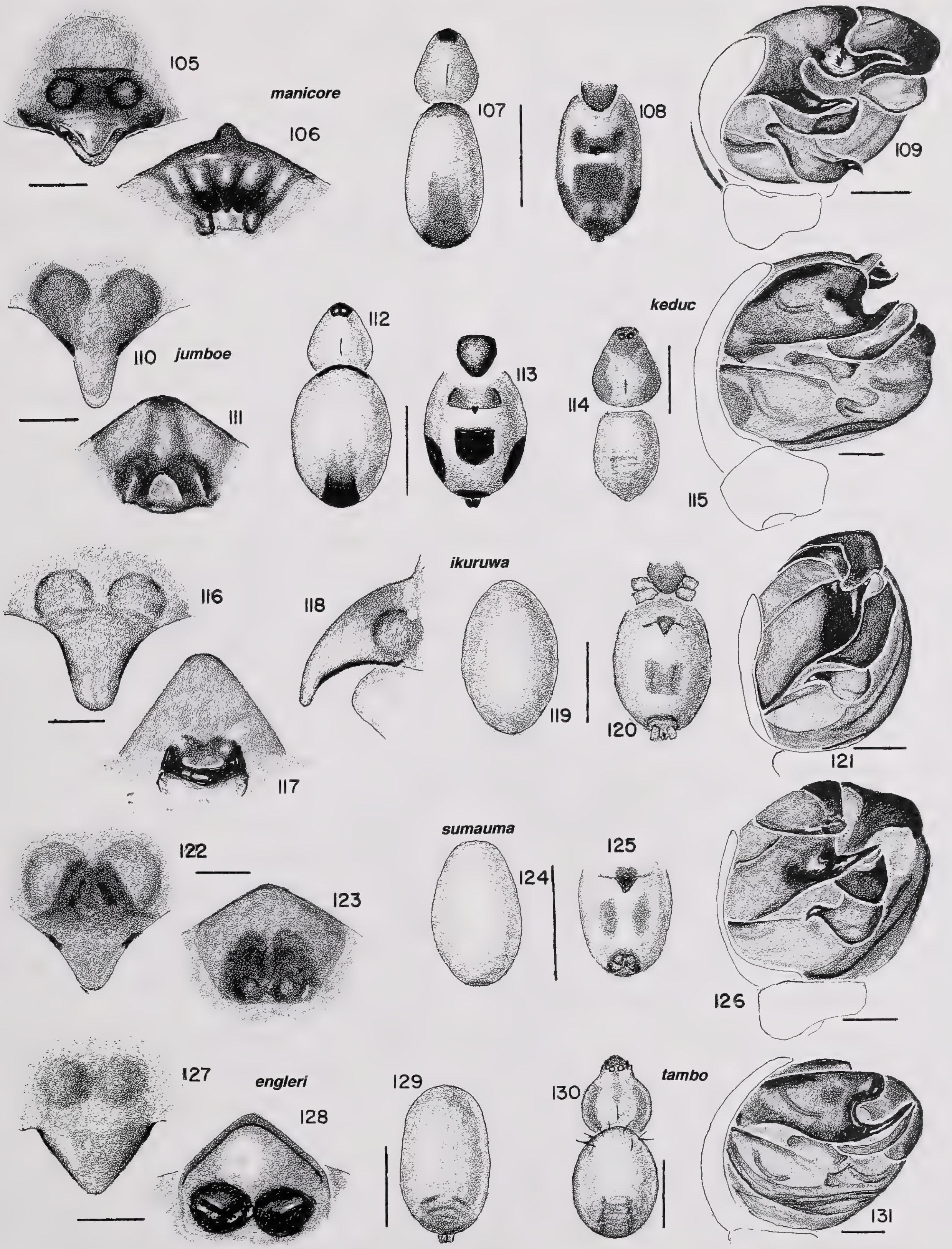
→

Figures 105–109. *Mangora manicore* new species. 105–108, female. 105, 106, epigynum. 105, ventral; 106, posterior. 107, carapace, abdomen. 108, sternum, abdomen. 109, left male palpus, mesal.

Figures 110–113. *M. jumboe* new species, female. 110, 111, epigynum. 110, ventral; 111, posterior. 112, carapace, abdomen. 113, sternum, abdomen.

Figures 114, 115. *M. keduc* new species, male. 114, carapace, abdomen. 115, palpus, mesal.

Figures 116–121. *M. ikuruwa* new species. 116–120, female. 116–118, epigynum. 116, ventral; 117, posterior; 118, lateral. 119, abdomen, dorsal. 120, sternum, abdomen. 121, male palpus, mesal.



Figures 122–126. *M. sumauma* new species. 122–125, female. 122, 123, epigynum. 122, ventral; 123, posterior. 124, abdomen, dorsal. 125, abdomen, ventral. 126, male palpus, mesal.

Figures 127–129. *M. engleri* new species, female. 127, 128, epigynum. 127, ventral; 128, posterior. 129, abdomen, dorsal.

Figures 130, 131. *M. tambo* new species, male. 130. carapace, abdomen. 131, palpus, mesal.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

structure above it, separated by a deep notch (center of Fig. 109).

Distribution. Amazon region (Map 1I).

Specimens Examined. No other specimens were found.

Mangora jumboe new species
Figures 110–113; Map 1F

Holotype. Female holotype from Cayenne, Jumboe River [04°04′S, 78°56′W, Zamora-Chinchipe], Ecuador, 1 June 1965 (L. Peña) in MCZ. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Carapace whitish, eye region black. Sternum black. Trochanters and rim of adjacent articles black, distal leg articles gray, indistinctly marked with some longitudinal lines and rings. Abdomen: whitish, dorsum marked with black (Fig. 112); venter also contrastingly marked (Fig. 113). Posterior eye row procurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 1.0 diameter apart, 0.6 from laterals. Posterior median eyes 0.8 diameter apart, 1.0 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Sternum domed. Total length 2.2 mm. Carapace 0.8 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.5 high. First femur 0.9 mm, patella and tibia 0.9, metatarsus 0.8, tarsus 0.4. Second patella and tibia 0.8 mm, third 0.6, fourth 0.8.

The male is not known.

Variation. Total length of females 2.2 to 2.3 mm.

Diagnosis. Mangora jumboe epigynum has a tongue (Fig. 110) and differs from *M. ikuruwa* (Fig. 117) in posterior view by having a light-colored depression as long as wide (Fig. 111).

Distribution. Southeastern Ecuador (Map 1F).

Specimens Examined. No other specimens were found.

Mangora keduc new species
Figures 114, 115; Map 1H

Holotype. Male holotype from Reserva Florestal Adolpho Ducke, Manaus, Amazonas, Brazil, 26 July 1973 (Lindalva), in MCN 20049. The specific name is an arbitrary combination of letters.

Description. Male holotype. Prosoma yellowish white, except carapace orange with gray cephalic region and sides (Fig. 114). Abdomen: whitish (Fig. 114). Posterior eye row procurved. Ocular quadrangle longer than wide, posterior widest. Posterior median eyes 1.4 diameters of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 1.0 diameter apart, 0.3 from laterals. Posterior median eyes 1.0 diameter apart, 0.5 from laterals. [Fourth femur with a long, ventral, proximal macroseta.] Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 2.6 mm. Carapace 1.6 mm long, 1.3 wide in thoracic region, 0.4 wide behind lateral eyes, 1.5 high. First femur 1.7 mm, patella and tibia 1.7, metatarsus 1.2, tarsus 0.7. Second patella and tibia 1.6 mm, third 0.9, fourth [lost].

The female is not known.

Variation. Total length of males 2.6 to 2.7 mm. The notch at the tip of the embolus is deeper and more rounded in a specimen from Reserva Campina. Although the holotype has lost the fourth legs, fourth legs of other specimens show the macroseta.

Diagnosis. Mangora keduc differs from *M. ikuruwa* and *M. sumauma* by having a thorax with a gray band (Fig. 114), and from *M. tambo* (Fig. 131) by having the palpus with shorter lobe above the embolus (1 h in Fig. 115).

Distribution. Amazon region (Map 1H).

Specimens Examined. BRAZIL *Pará:* Jacareacanga, Oct. 1959, 1♂ (M. Alvarenga, AMNH). *Amazonas:* Manaus, Reserva de Campina, 17 Aug. 1978, 1♂ (C. P. Albuquerque, MCN 23564); 80 km N Manaus, Colosso Reserve, 23 Apr. 1990, 1♂ (H. G. Fowler et al., MCZ).

Mangora ikuruwa new species
Figures 116–121; Map 2A

Holotype. Female holotype, male paratype from Canje Ikuruwa River, 05°70′N, 57°50′W, Guyana, Aug.–Dec. 1961 (G. Bentley), in AMNH. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellow, gray eye region and sternum. Abdomen: dorsum with a gray ring around spinnerets (Fig. 120); venter with central gray square (Fig. 120). Posterior eye row procurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.4 their diameter apart, 0.4 from laterals. Posterior median eyes 0.6 diameter apart, 0.7 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 2.8 mm. Carapace 1.1 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.8 high. First femur 1.2 mm, patella and tibia 1.2, metatarsus 0.8, tarsus 0.5. Second patella and tibia 1.0 mm, third 0.7, fourth 1.1.

Male paratype. Coloration as in female, book lungs gray. Posterior eye row procurved. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.8 diameters of anterior medians; lateral eyes 0.6 diameters. Anterior median eyes 0.4 diameter apart, 0.4 from laterals. Posterior median eyes 0.5 diameter apart, 0.6 from laterals. Height of clypeus equals 1.5 diameters of anterior median eye. Total length 2.1 mm. Carapace 0.9 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.7 high. First femur 1.0 mm, patella and tibia 1.1, metatarsus 0.9, tarsus 0.4. Second patella and tibia 0.8 mm, third 0.6, fourth 1.1.

Males and females were collected together.

Variation. Total length of females 2.2 to 2.8 mm. A male paratype has one anterior median eye reduced in size.

Diagnosis. The posterior view of the epigynum of *M. ikuruwa* differs from that of *M. jumboe* (Fig. 111) by a transverse oval depression (Fig. 117), and from *M. logrono* (Fig. 92) by having the depression smaller.

The male palpus differs from that of *M. sumauma* (Fig. 126) by having a large dark bulge, the conductor, below the embolus (Fig. 121).

Natural History. The holotype came from forest savanna; the specimen from Venezuela from humid forest.

Distribution. Guyana, southern Venezuela, Peru (Map 2A).

Specimens Examined. VENEZUELA *Bolívar:* 40 km W Santa Elena, 7 July 1987, 1♀ (S. and J. Peck, AMNH). PERU *Huánuco:* La Divisoria, 1,700 m, 23 Sep.–3 Oct. 1946, 1♀ (F. Woytkowski, AMNH).

Mangora sumauma new species
Figures 122–126; Map 1F

Holotype. Female holotype and male paratype from Boca do Sumaúma, near Tefé, Amazonas, Brazil, 16 Oct. 1992 (S. H. Borges) in MCN 23072. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellow. Abdomen: dorsum white (Fig. 124); venter with two indistinct, gray patches and gray ring around spinnerets (Fig. 125). Posterior eye row procurved. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.8 diameter apart, 0.3 from laterals. Posterior median eyes 1.0 diameter apart, 1.0 from laterals. Height of clypeus equals 1.2 diameters of anterior median eyes. Total length 2.1 mm. Carapace 0.9 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.6 high. First femur 0.9 mm, patella and tibia 1.0, metatarsus 0.8, tarsus 0.3. Second patella and tibia 0.8 mm, third 0.6. Fourth femur 1.1 mm, patella and tibia 0.9, metatarsus 0.8, tarsus 0.3.

Male paratype. Coloration as in female, sternum slightly gray, square ventral patch, epigastric region gray. Posterior eye row procurved. Ocular quadrangle wider than long, anterior widest. Posterior median

eyes 0.8 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.6 diameter apart, 0.1 from laterals. Posterior median eyes 0.4 diameter apart, 0.9 from laterals. Height of clypeus equals 1.2 diameters of anterior median eyes. Total length 1.9 mm. Carapace 0.9 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.6 high. First femur 0.8 mm, patella and tibia 1.0, metatarsus 0.8, tarsus 0.5. Second patella and tibia 0.8 mm, third 0.6. Fourth femur 1.1 mm, patella and tibia 0.8, metatarsus 0.7, tarsus 0.4.

Males and females have been collected together.

Variation. Total length of females 2.1 to 2.5 mm, males 1.8 to 2.2. Some specimens are darker, with abdomen dorsum having a black posterior and wide longitudinal band and lateral gray patches.

Diagnosis. The posterior view of the epigynum of *M. sumauma* differs from that of *M. ikuruwa* and *M. jumboe* by having two separate, circular depressions in a dark area (Fig. 123) and from *M. caparu* (Figs. 98, 99) by having a longer tongue in ventral view.

The male palpus differs from that of *M. keduc* and *M. ikuruwa* by having the dark sclerite behind the embolus, part of the conductor, subcircular (Fig. 126).

Natural History. In reserves north of Manaus, specimens have been collected inside forests and on border of forests.

Distribution. Amazon region (Map 1F).

Paratype. BRAZIL *Amazonas:* near Tefé, Boca do Sumaúma, 17 Oct. 1992, 2♂ (S. H. Borges, MCN 22971).

Specimens Examined. BRAZIL *Amazonas:* Parque Nacional do Jaú Moura, 16 Mar. 1999, 1♀ (J. H. Borges, IBSP 28490); near Manaus, km 41 Reserve, 1991, many specimens (H. G. Fowler et al., HGF); 80 km N Manaus, 02°24′S, 59°52′W, 17 Jan. 1989, 1♂ (H. G. Fowler, INPA); Reserve of km 80, 1989–1992, 2♀, 1♂ (H. G. Fowler, MCZ); Manaus, Reserva Florestal Adolpho Ducke, 26 July 1973, 1♀ (L. P. Albuquerque, MCN 27431); 15 Aug. 1991, 1♂ (A. D. Brescovit, MCN 21394); 15–23 Aug. 1991, 1♂ (A. D. Brescovit, MCN 21405); 80 km N Manaus, Porto Alegre Reserve, 1989–1992, 2♀ (H. G. Fowler, HGF); ca. 80 km N Manaus, Cabo Frio Reserve, very common, 1989–1991 (H. G. Fowler et al., HGF); 1989–1992, 1♂ (H. G. Fowler, IBSP); 80 km N Manaus, Colosso Reserve, very common, 1989–1991 (all H. G. Fowler, R. S. Vieira, E. Venticinque, HGF); 1989–1992, 2♀, 1♂ (H. G. Fowler, MCZ); Reserve C. de Powell, 80 km N Manaus, 20 Apr. 1991, 1♂ (H. G. Fowler, HGF); Reserve Gavião, 24 Apr. 1991, 1♀ (H. G. Fowler, HGF).

Mangora engleri new species
Figures 127–129; Map 1H

Holotype. Female holotype from Chiguaza, Prov. Wakani, Morona-Santiago, Ecuador, 22 May–3 June 1977 (N. Engler), in MCZ. The species is named after the collector.

Description. Female holotype. Prosoma light yellowish, gray endites and labium. Abdomen: whitish, dorsum with indistinct posterior chevrons (Fig. 129). Posterior eye row procurved. Ocular quadrangle slightly longer than wide, anterior widest. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.6 their diameter apart, 0.4 from laterals. Posterior median eyes 0.5 diameter apart, 0.8 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Total length 3.0 mm. Carapace 1.3 mm long, 1.1 wide in thoracic region, 0.6 wide behind lateral eyes, 0.6 high. First femur 1.5 mm [other leg articles lost].

The male is not known.

Diagnosis. The female of *M. engleri* differs from that of *M. sumauma* (Figs. 122, 123) and others with a tongue-bearing epigynum in posterior view, in having slit-shaped openings within adjacent, dark circles (Fig. 128).

Distribution. Southeastern Ecuador (Map 1H).

Specimens Examined. No other specimens were found.

Mangora tambo new species
Figures 130, 131; Map 1H

Holotype. Male holotype from Zona Reservada Tambopata, 290 m, 12°50′S, 69°17′W, Madre de Dios, Peru, 5 May 1988 (D. Silva D.), in MCZ. The specific name is a noun in apposition of an arbitrary combination of letters. Tambo is Spanish for an inn.

Description. Male holotype. Prosoma light orange with a light gray band on each side of thoracic region of carapace (Fig. 130). Abdomen: dorsum with posterior median gray ladder-mark (Fig. 130). Posterior eye row slightly procurved. Ocular quadrangle as wide as long, anterior widest. Posterior median eyes 0.9 diameter of anterior medians; lateral eyes 0.4 diameter. Anterior median eyes their diameter apart, 0.2 from laterals. Posterior median eyes 0.5 their diameter apart, 0.5 from laterals. Height of clypeus equals 0.7 diameter of anterior median eye. Fourth femur with large ventral, proximal macroseta. Total length 2.8 mm. Carapace 1.4 mm long, 1.2 wide in thoracic region, 0.4 wide behind lateral eyes, 0.8 high. First femur 1.3 mm, patella and tibia 1.6, metatarsus 1.3, tarsus 0.7. Second patella and tibia 1.3 mm, third 1.0, fourth 1.3.

The male, although widespread, could not be matched to a female. The male from Sta. Teresa, Peru, was collected with females of *M. chacobo* and *M. dianasilvae.*

Variation. Total length of males 2.4 to 2.8 mm. The bands on the carapace can be very light, barely visible.

Diagnosis. The male of *M. tambo* (Fig. 131) differs from that of *M. keduc* (Fig. 115) by having a longer lobe above the embolus in the palpus (1 h in Fig. 131), from *M. apaporis* (Fig. 423) by having the tip of the embolus separated from the lobe and also by the general coloration of the male.

Distribution. Upper Amazon: Peru (Map 1H).

Specimens Examined. PERU *Loreto:* Estiron, Río Ampiacu, 13 Nov.–9 Dec. 1961, 1♂ (B. Malkin, AMNH); Jenaro Herrera, 04°45′S, 73°45′W, ca. 100 m, 28 Aug. 1988, 1♂(D. Silva D., MUSM). *Amazonas:* Cordillera del Cóndor, alto Río Comaina, Puesto de Vigilancia 22, 850–1,150 m, 29 Oct. 1987, 3♂ (D. Silva D., MUSM). *Huánuco:* Sta. Teresa, Río Huallaga, 600 m, Aug. 1954, 1♂ (F. Woytkowski, CAS); Estacion Dantas, La Molina, SW de Puerto Inca, 270 m, 09°38′S, 75°00′W, 18 May–1 June 1987, 1♂ (D. Silva D., MUSM). *Pasco:* Quebrada Chispa, NW Iscozacin, ca. 345 m, ca. 10°10′S, 75°15′W, 1 Nov. 1986, 2♂ (D. Silva D., MUSM). *Madre de Dios:* 15 km E Puerto Maldonado, 200 m, 27 June–10 July 1989, 6♂ (D. Silva D., MUSM).

Mangora enseada new species
Figures 132–136; Map 2B

Holotype. Female holotype from Enseada das Palmas, Ilha Grande, Rio de Janeiro, Brazil, 2–12 Feb. 1997 (M. J. Ramírez), in MACN. The specific name is a noun in apposition after the type locality. Enseada is Portuguese for a cove.

Zygiella decolorata:—Roewer, 1942: 887.
Mangora decolorata:—Levi, 1974: 271.

Note. The holotype of *Zilla decolorata* (BMNH) was examined by me in the 1970s. It is now determined to be a male of a new species, *M. enseada*, coming from Blumenau [Paraná], Brazil. The specimen is labeled *Zilla decolorata* C. L. Koch, but Keyserling previously described a female with this name from Guatemala, not Brazil. Keyserling's type is lost. *Zilla decolorata* C. L. Koch was never described.

According to Bonnet (1957), C. L. Koch (1837: 5, 1840: 400) described a *Z. decora*, which is a synonym of *Mangora acalypha* (Walckenaer) found in Europe, but it also has been cited in the last century as *decolorata.* Roewer (1942) and Platnick (2006) list *Zygiella decolorata* Keyserling as coming from Brazil, but Keyserling's species came from Guatemala.

Description. Female holotype. Prosoma yellow; carapace lighter than legs. Large black circles around secondary eyes. Abdomen: dorsum with posterior median gray ladder, white pigment spots on sides (Fig. 134); venter without pattern. Posterior eye row procurved. Ocular quadrangle longer than wide posteriorly, posterior widest. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.6 diameter apart, 0.6 from laterals. Posterior median eyes 0.8 diameter apart, 0.8 from laterals. Height of clypeus equals 0.6 diameter of anterior median eyes. Total length 4.5 mm. Carapace 1.8 mm long, 1.3 wide in thoracic region, 0.8 wide behind posterior eyes, 0.8 high. First femur 2.1 mm, patella and tibia 2.2, metatarsus 1.7, tarsus

0.8. Second patella and tibia 1.9 mm, third 1.3, fourth 2.0.

Male from Argentina. Prosoma orange. Abdomen: whitish, dorsally with two longitudinal bands of white pigment spots. Posterior eye row procurved. Ocular quadrangle longer than wide, posterior widest. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.7 diameter apart, 0.7 from laterals. Posterior median eyes 1.0 diameter apart, 1.0 from laterals. Height of clypeus equals 1.3 diameters of anterior median eyes. Total length 2.7 mm. Carapace 1.5 mm long, 1.4 wide in thoracic region, 0.6 wide behind lateral eyes, 0.7 high. First femur 1.5 mm, patella and tibia 1.7, metatarsus 1.3, tarsus 0.7. Second patella and tibia 1.5 mm, third 0.9, fourth 1.5 mm.

Males and females have been collected together.

Variation. Total length of females 3.1 to 4.8 mm.

Diagnosis. The shallow grooves of the epigynum in posterior view of *M. enseada* females (Fig. 133) differ from those of *M. grande* (Fig. 18) and others with a pair of grooves by the presence of a tongue (Fig. 132).

The palpus of the male differs from others by having a large tooth proximally on the embolus sclerite (below the embolus in Fig. 135).

Distribution. Southern Brazil, from Rio de Janeiro to northeastern Argentina (Map 2B).

Specimens Examined. BRAZIL *Minas Gerais:* Lavras, 29 Mar. 1979, 1♀ (W. D. Fronk, MCZ). *São Paulo:* Cotia, Dec. 2002, 2♀, 1♂ (A. A. Nogueira, M. C. Silveira, MZSP); Mar. 2003, 1♀ (I. Cizauskas, MZSP). *Paraná:* Morretes, Serra da Graciosa, 9–20 Jan. 1995, 1♀ (Lab. Arachnol, MCP 6931). *Santa Catarina:* Blumenau, 1♂ (BMNH). ARGENTINA *Misiones:* Parque Nacional del Iguazú, July 1983, 1♀ (P. Goloboff, MACN); 8–15 Feb. 1993, 1♂ (M. J. Ramírez, MACN); 22–30 Aug. 1986, 1♂ (M. J. Ramírez, MACN).

Mangora brokopondo new species
Figures 137–140; Map 4A

Holotype. Female holotype from Browns Berg, Brokopondo Prov., 05°N, 55°27′W [4°53′N, 55°13′W], Suriname, 20 Feb. 1982 (D. Smith Trail), in MCZ. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Carapace yellowish, with a black patch on each side of thoracic region, cephalic region black (Fig. 140). Median area of clypeus black. Chelicerae yellowish. Labium, endites gray. Sternum and coxae yellowish, slightly gray. Legs brown. Abdomen: dorsum white, with white pigment spots and contrasting black patches (Fig. 140); venter light gray, epigastric area yellowish. Posterior eye row strongly procurved. Ocular quadrangle longer than wide, anterior slightly widest. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.4 diameter. Anterior median eyes 0.6 diameter apart, 0.6 from laterals. Posterior median eyes 0.6 diameter apart, 0.5 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Total length 3.3 mm. Carapace 1.6 mm long, 1.2 wide in thoracic region, 0.6 wide behind lateral eyes, 0.7 high. First femur 1.7 mm, patella and tibia 1.8, metatarsus 1.4, tarsus 0.6. Second patella and tibia 1.7 mm, third 1.0, fourth 1.7.

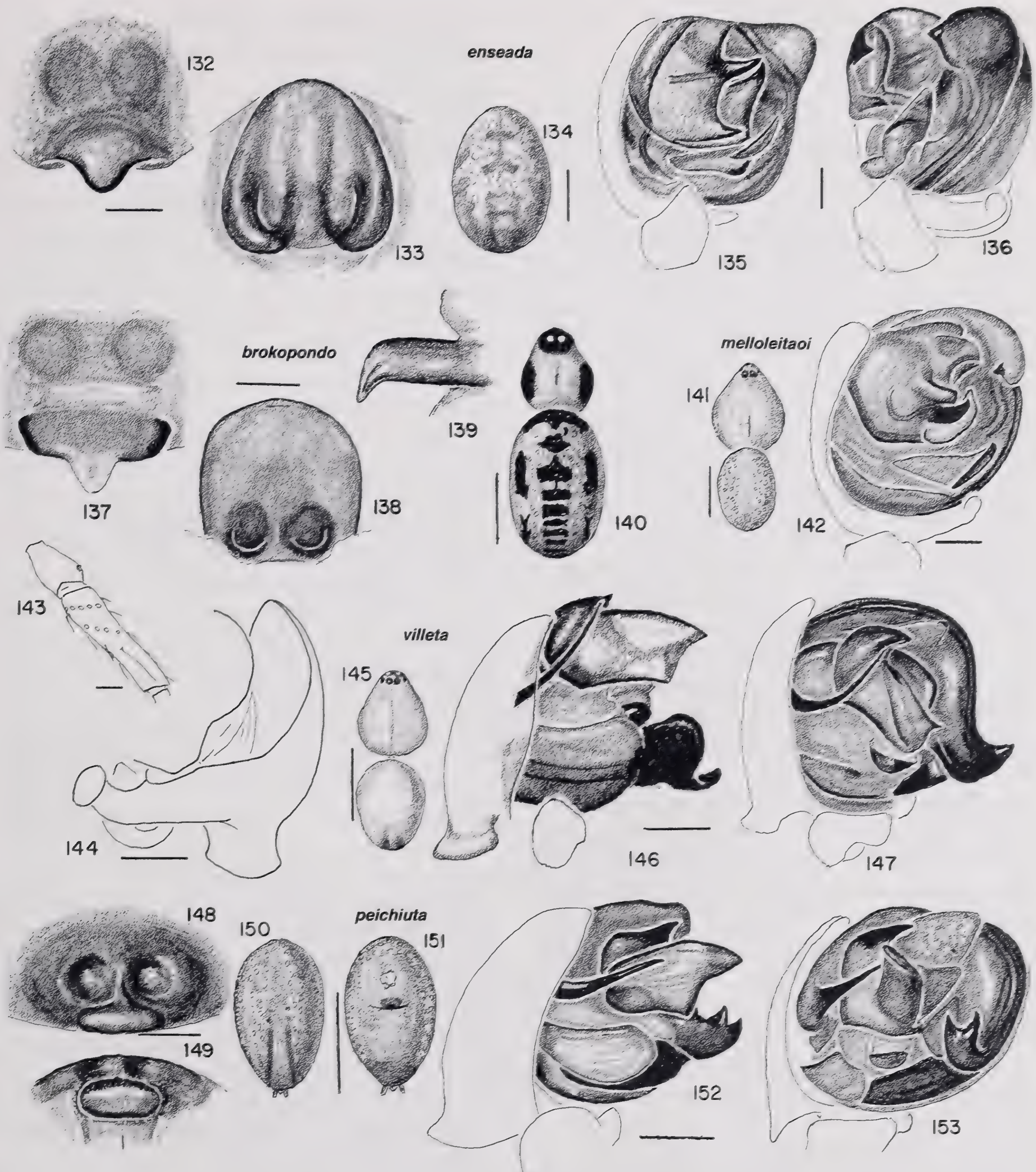
The male is not known.

Variation. Total length of females 3.0 to 3.3 mm. Specimens from Pará have the posterior median eyes slightly larger than anterior median eyes.

Diagnosis. Mangora brokopondo differs from all others by its contrasting coloration (Fig. 140) and by the epigynum, which is a thin, ventrally protruding shelf (Fig. 139) with a small tongue (Fig. 137) and, in posterior view far dorsally, the posterior openings, each within a black semicircle (Fig. 138).

Distribution. Guyana, Suriname, and Pará State, Brazil (Map 4A).

Specimens Examined. GUYANA *Bartica Distr.:* Kartabo, 1921, 1♀ (AMNH); Apr. 1924, 1♀ (W. Beebe et al., AMNH). BRAZIL *Pará:* Melgaço, Flona de Caxiuanã, 11 Aug. 1996, 2♀ (A. A. Lise, MCP 9318, 9376).



Figures 132–136. *Mangora enseada* new species. 132–134, female. 132, 133, epigynum. 132, ventral; 133, posterior. 134, abdomen, dorsal. 135, 136, left male palpus. 135, mesal; 136, ventral.

Figures 137–140. *M. brokopondo* new species, female. 137–139, epigynum. 137, ventral; 138, posterior; 139, lateral. 140, carapace, abdomen.

Figures 141, 142. *M. melloleitaoi* new species, male. 141, carapace, abdomen. 142, male palpus, mesal.

Figure 143. *M. peichiuta* new species, female, left third patella, tibia, with scars of macrosetae.

Figures 144–147. *M. villeta* new species, male. 144, cymbium, paracymbium. 145, carapace, abdomen. 146, 147, palpus, mesal.

Figures 148–153. *M. peichiuta* new species. 148–151, female. 148, 149, epigynum. 148, ventral; 149, posterior. 150, 151, abdomen. 150, dorsal; 151, ventral. 152, 153, male palpus. 152, mesal; 153, ventral.

Scale lines: 1.0 mm; genitalia and Fig. 143, 0.1 mm.

Mangora melloleitaoi new species
Figures 141, 142; Map 2B

Holotype. Male holotype from Carmo do Rio Claro, Minas Gerais, Brazil [no date] (J. C. Carvalho), in MNRJ 2356. This species is named after the Brazilian arachnologist C. F. de Mello-Leitão.

Mangora strenua:—Mello-Leitão. 1947: 13. Misidentification.

Note. The specimens examined had been labeled by Mello-Leitão as *M. strenua*, but Mello-Leitão cites specimens from different localities as this species. They were probably different species, all with a pair of black patches on the posterior of the abdomen, but when I examined this specimen, I found the black patches faded and disappeared (Fig. 141).

Description. Male holotype. Prosoma yellowish. Posterior median eyes with distinct black rings. Abdomen: lighter, dorsum with two wide rows of white pigment spots (Fig. 141). Posterior eye row procurved. Ocular quadrangle longer than wide, anterior slightly widest. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 1.0 diameter apart, 0.5 from laterals. Posterior median eyes 1.0 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Fourth femur with a dorsal proximal macroseta. Total length 3.1 mm. Carapace 1.6 mm long, 1.3 wide in thoracic region, 0.6 wide behind lateral eyes, 0.8 high. First femur 1.5 mm, patella and tibia 1.8, metatarsus 1.2, tarsus 0.7. Second patella and tibia 1.6 mm, third 0.9, fourth patella and tibia 1.6.

The female is not known.

Diagnosis. The palpus is lightly sclerotized, and is separated from *M. tambo* (Fig. 131) by the short, thick, black, curved embolus with only a slender distal lobe above it (Fig. 142).

Distribution. Minas Gerais, Brazil (Map 2B).

Specimens Examined. No other specimens were found.

Mangora villeta new species
Figures 144–147; Map 2A

Holotype. Male from Villeta, 850 m, Cundinamarca, Colombia, 17 June 1973 (P. Schneble), in MCZ. The specific name is a noun in apposition after the type locality.

Description. Male holotype. Prosoma yellowish, with a gray longitudinal line on carapace. Abdomen: whitish; dorsum with two posterior, short, black bands (Fig. 145); venter with black book lung covers, and gray anterior to spinnerets. Posterior eye row straight. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 0.7 diameter of anterior medians; anterior lateral eyes 0.6 diameter, posterior 0.4. Anterior median eyes 0.4 diameter apart, 0.3 from laterals. Posterior median eyes 0.4 diameter apart, 1.0 from laterals. Height of clypeus equals 1.7 diameters of anterior median eyes. Clypeus with four adjacent macrosetae having their tips touching. Total length 2.7 mm. Carapace 1.2 mm long, 0.8 wide in thoracic region, 0.4 wide behind lateral eyes, 0.5 high. First femur 1.4 mm, patella and tibia 1.4, metatarsus 1.2, tarsus 0.6. Second patella and tibia 1.2 mm, third 0.8, fourth 1.2.

The female is not known.

Diagnosis. The male *M. villeta* palpus differs from most male *Mangora* by having a bulge on the proximal end of the cymbium (8 h in Figs. 146, 147), and an extended paracymbium (8 h in Fig. 144). It differs from *M. peichiuta* by the placement of the embolus, shape of the conductor and terminal apophysis (Figs. 146, 147).

Distribution. Only known from central Colombia (Map 2A).

Specimens Examined. No other specimens have been collected.

Mangora peichiuta new species
Figures 143, 148–153; Map 2B

Holotype. Female holotype and one male paratype from Bahía Negra Peichiuta, Alto Paraguay, Paraguay, 18–24 June 1988 (V. and B. Roth), in CAS. The specific name is a noun in apposition after the type locality.

Description. Female holotype [in poor condition]. Prosoma orange, eyes with black rings. Abdomen: dorsum with posterior, longitudinal pair of gray lines, lateral to which is a band of white pigment spots (Fig. 150); venter with posterior dark gray area (Fig. 151). Posterior eye row slightly procurved. Ocular quadrangle slightly longer than wide, anterior widest. Posterior median eyes 0.9 diameter of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 1.2 diameters apart, 1.0 from laterals. Posterior median eyes 1.0 diameter apart, 1.8 from laterals. Height of clypeus equals 1.2 diameters of anterior median eyes. Total length ca. 2.3 mm. Carapace 0.8 mm long, 0.3 wide behind lateral eyes, 0.6 high. First femur 1.3 mm. Second patella and tibia 1.2 mm, third 0.7. [Other leg articles lost.]

Male paratype. Coloration as in female. Posterior eye row slightly procurved. Ocular quadrangle slightly longer than wide, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 1.0 diameter apart, 1.0 from laterals. Posterior median eyes 1.0 diameter apart, 1.8 from laterals. Height of clypeus equals 1.2 diameters of anterior median eyes. Total length ca. 1.8 mm. Carapace 0.8 mm long, 0.7 wide in thoracic region 0.3 wide behind lateral eyes, 0.5 high. First femur 1.1 mm, patella and tibia 1.2, metatarsus 1.0, tarsus 0.5. Third patella and tibia 0.6 mm, fourth 1.1. [Other leg articles lost.]

Male and female were collected together.

Diagnosis. The ventral view of the epigynum of *M. peichiuta* differs from all others by having a pair of depressions separated by an upside-down T-shaped ridge (Fig. 148) and a transverse, raised bar in posterior view (Fig. 149).

The male *M. peichiuta* palpus differs from most male species by having a bulge on the proximal end of the cymbium (8 h in Figs. 152, 153) and from *M. villeta* by the placement of the embolus, the shape of the conductor, and a terminal apophysis (Fig. 152).

Distribution. Only known from northern Paraguay (Map 2B).

Specimens Examined. No other specimens have been found.

Mangora missa new species
Figures 154–163; Map 2C

Holotype. Female holotype from Santa María, Misiones, Argentina, Oct. 1956, in MACN. The specific name is an arbitrary combination of letters, a noun in apposition.

Description. Female holotype light yellowish. Abdomen: dorsum with two posterior black patches and several transverse lines (Fig. 161); sides gray. Posterior eye row straight. Ocular quadrangle slightly longer than wide, rectangular. Posterior median eyes 1.3 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.7 diameter apart, 1.0 from laterals. Posterior median eyes 0.4 diameter apart, 1.2 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 3.3 mm. Carapace 1.3 mm long, 1.1 wide in thoracic region, 0.5 wide behind lateral eyes, 1.1 high. First femur 1.3 mm, patella and tibia 1.4, metatarsus 1.0, tarsus 0.4. Second patella and tibia 1.3 mm, third 0.8. Fourth femur 1.3 mm, patella and tibia 1.4, metatarsus 1.0, tarsus 0.4.

Males from San Antonio, Argentina. Darker than female. Abdomen: dorsum with an anterior gray patch and gray transverse lines more distinct. Posterior eye row slightly procurved. Ocular quadrangle square. Posterior median eyes 1.1 diameters of anterior medians; lateral eyes 0.9 diameter. Anterior median eyes 1.0 diameter apart, 0.8 from laterals. Posterior median eyes 0.8 diameter apart, 1.4 from laterals. Height of clypeus equals to 1.8 diameters of anterior median eyes. Total length 2.3 mm. Carapace 1.3 mm long, 1.2 wide in thoracic region, 0.3 wide behind lateral eyes, 0.7 high. First femur 1.2 mm, patella and tibia 1.3, metatarsus 1.0, tarsus

0.5. Second patella and tibia 1.2 mm, third 0.7, fourth 0.3.

Males and females have been collected together in Rio Grande do Sul and in Misiones, Argentina.

Variation. Total length of females 2.7 to 3.6 mm, males 2.3 to 2.9. One female had the lobe of the epigynum torn off. Figures 154, 155, 161 were made from the female holotype; Figures 156, 157, 162 from a female from Botelho, São Paulo; and Figures 158–160 from a female from Morro do Tigre, Rio Grande do Sul. The male (Fig. 163) came from Misiones Prov., Argentina; a lightly sclerotized male from Triunfo was used to touch up the illustration. Perhaps some females here illustrated belong to separate species.

Diagnosis. The epigynum of *M. missa* differs from that of most other species by the pair of adjacent dark round spots (center of Fig. 154, most distinct in Figs. 156, 158), and from *M. velha* by lacking the transverse swelling at the base of the tongue.

The male palpus differs from that of *M. velha* (Fig. 168) and others by the short, thick median apophysis (5 h in Fig. 163) and by the filiform embolus.

Distribution. Eastern, southern Brazil and northeastern Argentina (Map 2C).

Paratypes. ARGENTINA *Misiones:* Santa María, Nov.–Dec. 1952, 3♀ (M. J. Viana, MACN 3594, 3597).

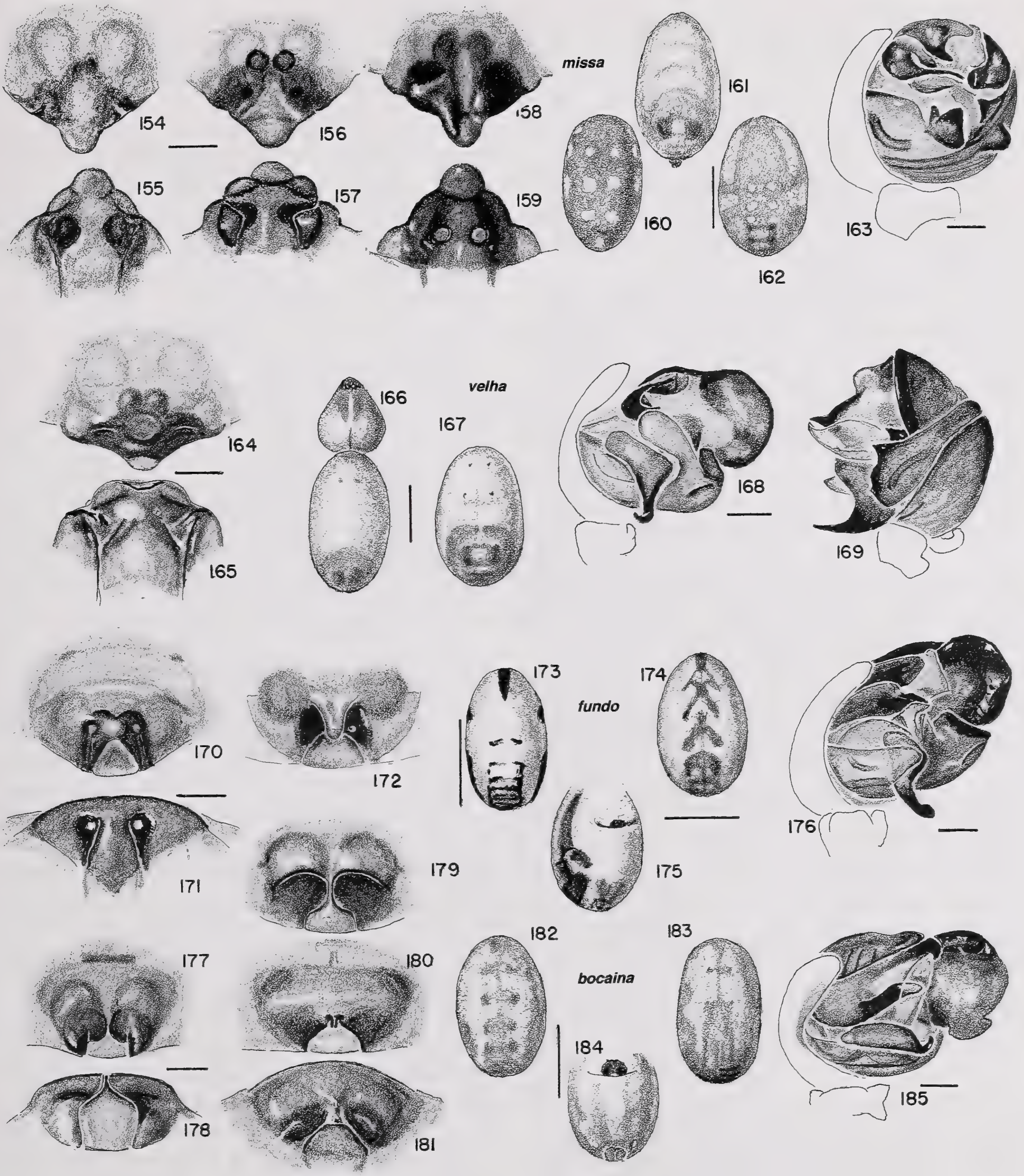
Specimens Examined. BRAZIL *Paraíba:* Areia, Mata do Guarim, 12 Apr. 1997, 1♀ (A. D. Brescovit, IBSP 10261). *Minas Gerais:* Lavras, 20 Sept. 1978, 1♀; 20 Mar. 1979, 1♀; 29 Mar. 1979, 1♀ (W. D. Fronk, MCZ). *Rio de Janeiro:* Rio de Janeiro, Reprêsa Rio Grande, Feb. 1976, 1♀ (M. Alvarenga, AMNH); Parque Nacional da Tijuca, Floresta dos Macacos, April 1961, 1♀ (M. Alvarenga, AMNH). *São Paulo:* Botucatu, Vitoriana, Fazenda Goldfarm, 18 Dec. 1986, 1♀ (I. M. P. Rinaldi, L. C. Forti, UBTU); São Miguel Arcanjo, Parque Estadual de Carlos Botelho, 14 Oct. 1990, 1♀ (A. B. Bonaldo, MCN 20476). *Paraná:* Jundiaí do Sul, 11 Aug. 1986, 1♀ (Equipe Profaupar, MCN 20286); Palmeira, 1 Oct. 1994, 1♀ (R. Bóçon, MCN 26612). *Rio Grande do Sul:* Estrela Velha (Barragem Itaúba), 7 Mar. 2001, 1♂ (R. Ott, MCN 33654); 20 Oct. 1998, 1♀ (A. Silva, MCN 29558); Salto do Jacuí, Horto See, 19 Oct. 1998, 1♀ (A. B. Bonaldo, L. Moura, MCN 29634); Porto Alegre, Morro Santana, 15 Dec. 1989, 1♀ (A. A. Lise, MCN 19169); Morro do Tigre, 29°50′S 50°52′W, 15 July 2000, 1♀ (A. B. Bonaldo, MCN 33091a); Rio Pardo, 1♀ (A. Rugo, MNRJ); Glorinha, São João, 29°52′S, 50°48′W, 14 July 2000, 1♂ (A. B. Bonaldo, MCN 33060); Triunfo, 15 Sep. 1977, 1♂ (E. H. Buckup, MCN 6533); 28 Nov. 1977, 1♀, 2♂ (E. H. Buckup, MCN 7327, 7343); Viamão, 2 Dec. 1994, 1♀ (A. A. Lise, MCP 7890); 17 Oct. 1995, 1♂ (A. A. Lise et al., MCP 8528); 16 Dec. 1995, 1♀ (A. A. Lise et al. MCP 9023a). ARGENTINA *Misiones:* San Antonio, Sep. 1956, 1♀, 1♂ (M. J. Viana, MACN).

Mangora velha new species
Figures 164–169; Map 2D

Holotype. Female holotype, one male and one female paratype from Estrela Velha, Rio Grande do Sul, Brazil, 20 Oct. 1998 (A. Silva), in MCN 9626. The specific name is a noun in apposition after the type locality. Velha is a Portuguese word for old.

Description. Female holotype. Prosoma yellow. Abdomen: whitish, dorsum with anterior white pigment spots on sides, posterior transverse bands, two of which are connected forming a rectangle (Fig. 166). Posterior eye row straight. Ocular quadrangle longer than wide, almost rectangular. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.9 diameter. Anterior median eyes 1.1 diameters apart, 1.0 from laterals. Posterior median eyes 0.7 diameter apart, 1.1 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 3.6 mm. Carapace 1.3 mm long, 1.1 wide in thoracic region, 0.4 wide behind lateral eyes, 0.8 high. First femur 1.3 mm, patella and tibia 1.3, metatarsus 1.0, tarsus 0.5. Second patella and tibia 1.2 mm, third 0.8. Fourth femur 1.2 mm, patella and tibia 1.3, metatarsus 0.8, tarsus 0.5.

Male paratype. Posterior eye row slightly procurved. Ocular quadrangle square. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 1.0 diameter apart, 1.0 from laterals. Posterior median eyes 0.7 diameter apart, 1.0 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 2.3 mm. Carapace 1.2 mm long, 1.1 wide in thoracic region, 0.5 wide behind lateral eyes,



Figures 154–163. *Mangora missa* new species. 154–162, female. 154–159, epigynum. 154, 156, 158, ventral; 155, 157, 159, posterior. 160–162, abdomen, dorsal. 163, left male palpus, mesal.

Figures 164–169. *M. velha* new species. 164–167, female. 164, 165, epigynum. 164, ventral; 165, posterior. 166, carapace, abdomen. 167, abdomen, dorsal. 168, 169, male palpus. 168, mesal; 169, ventral.

Figures 170–176. *M. fundo* new species. 170–175, female. 170–172, epigynum. 170, ventral; 171, posterior; 172, anteroventral. 173–175, abdomen, 173, 174, dorsal; 175, lateral-ventral. 176, male palpus, mesal.

Figures 177–185. *M. bocaina* new species. 177–184, female. 177–181, epigynum. 177, 180, ventral; 178, 181, posterior; 179, anteroventral. 182–184, abdomen. 182, 183, dorsal; 184, ventral. 185, male palpus, mesal.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

0.7 high. First femur 1.2 mm, patella and tibia 1.3, metatarsus 1.0, tarsus 0.5. Second patella and tibia 1.2 mm, third 0.7, fourth 1.2.

Male and females have been collected together.

Variation. Total length of males 2.3 to 2.4 mm. The illustrations were made from the female holotype, except Figure 166 from the paratype.

Diagnosis. Mangora velha female differs from most species by the pair of adjacent black circles on the ventral face of the epigynum (center of Fig. 164); it differs from *M. missa* by having a transverse swelling at the base of the tongue (Fig. 164), whereas *M. missa* has a median, longitudinal groove.

The male palpus differs from that of *M. missa* by having a median apophysis with an extended, pointed tip (7 h in Fig. 168) and a thick embolus partly hidden by the conductor (11 h in Fig. 168).

Distribution. Southern Brazil (Map 2D).

Specimens Examined. BRAZIL *Santa Catarina:* Bombas [27°08′S, 48°32′W], 14 Feb. 1990, 1♂ (A. D. Brescovit, MCN 19496).

Mangora fundo new species
Figures 170–176; Map 2E

Holotype. Female holotype, two male, four female paratypes from Passo Fundo, Rio Grande do Sul, Brazil, 1 Aug. 1986 (A. A. Lise), in MCN 15868. The specific name is a noun in apposition after the type locality. Fundo is Portuguese for deep.

Description. Female holotype. Prosoma orange. Abdomen: dorsum with some silver pigment spots with a gray and black pattern (Figs. 173–175). Posterior eye row procurved. Ocular quadrangle as long as wide posteriorly, posterior widest. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 1.0 diameter apart, 1.0 from laterals. Posterior median eyes 1.0 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 3.3 mm. Carapace 1.2 mm long, 1.0 wide in thoracic region, 0.5 wide behind lateral eyes, 0.7 high. First femur 1.6 mm, patella and tibia 1.8, metatarsus 1.1, tarsus 0.5. Second patella and tibia 1.6 mm, third 0.9, fourth 1.3.

Male from Passo Fundo. Prosoma orange. Abdomen: whitish, dorsum with a gray cardiac mark and pairs of posterior, short transverse gray lines. Posterior eye row procurved. Ocular quadrangle longer than wide, posterior widest. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 1.0 diameter. Anterior median eyes 1.3 diameter apart, 0.8 from laterals. Posterior median eyes 1.2 diameters apart, 1.2 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 2.3 mm. Carapace 1.1 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.5 high. First femur 1.2 mm, patella and tibia 1.3, metatarsus 1.2, tarsus 0.5. Second patella and tibia 1.2 mm, third 0.7, fourth 1.1.

Males and females have been collected together.

Variation. Total length of females 2.3 to 3.3 mm, males 2.2 to 2.6.

Diagnosis. The *M. fundo* epigynum has a median swelling anterior to the triangular light area (Fig. 170), whereas the similar *M. bocaina* (Fig. 177) has a narrow septum anterior to the light area. In posterior view *M. fundo* has a pair of depressions and the median plate is ventrally wide (Fig. 171), whereas *M. bocaina* has a septum extending ventrally from a median plate (12 h in Figs. 178, 181).

The male palpus differs from that of *M. bocaina* (Fig. 185) by the prominent median apophysis projection (5 h in Fig. 176) and the relatively indistinct small, sclerotized embolus (center of Fig. 176).

Distribution. Southern Brazil (Map 2E).

Paratypes. BRAZIL *Rio Grande do Sul:* Passo Fundo, 13 Oct. 1985, 2♀ (A. A. Lise, MCN 14260).

Specimens Examined. BRAZIL *Rio Grande do Sul:* Bajé, 28 Oct. 1981, 1♀, 1♂ (A. A. Lise, MCN 9957); Canela, 10 July 1984, 1♀ (A. A. Lise, MCN 12247); Canoas, 14 Oct. 1990, 1♀ (E. H. Buckup, MCN 20087); Candelária, Cerro do Botucaraí, 4–6 Sep. 2000, 1♂ (A. Franceschini, MCN 33148); Eldorado do Sul, 12–19 Sep. 1993, 3♀ (A. Braul, C. Queiróz,

MCP 4118); Estrela Velha, 6 May 1998, 1♂ (M. A. L. Marques, MCN 29363a); Arroio dos Ratos, Fazenda Recanto da Figueira, 1 Aug. 1986, 1♀ (A. D. Brescovit, MCN 15471); General Câmara, 16 Sep. 1982, 1♀ (A. A. Lise, MCN 10732); Guaíaba, Fazenda São Maximiano, 2 June 1995, 1♀ (A. A. Lise et al., MCP 6712); 9 Jan 1996, 1♂ (A. Lise et al., MCP 8217); Montenegro, 3 Nov. 1977, 1♀ (M. H. Galileo, MCN 7112); 15 Dec. 1977, 1♂ (H. Bischoff, MCN 7515); Pinhal Grande, Margens do Rio Jacuí, 7 May 1998, 1♀ (M. A. L. Marques, MCN 23388); Porto Alegre, 18 Jan. 1992, 1♀, 1♂ (M. A. L. Marques, MCN 21967); Porto Alegre, Jardim Botânico, 11 Oct. 1994, 1♂ (A. D. Brescovit, MCN 26139); Vila Manresa, Roua, Porto Alegre, 27 Sep. 1985, 1♂ (T. Arígony, MCN 13431); Santa Rosa, 2 Jan. 1984, 1♀ (A. D. Brescovit, MCN 12151); São Sepé, 30 Dec. 1987, 1♀, 1♂ (C. C. Kessler, MCN 17277); Viamão, Parque Estadual de Itapuã, Apr. 2002, 1♂ (L. E. C. Schmidt, MCN 34768); Viamão, 19 Jan. 1977, 1♀ (E. H. Buckup, MCN 5297); Viamão, Águas Belas, 6 Jan. 1977, 1♀ (A. A. Lise, MCN 5764); 30 Mar. 1977, 1♀ (E. H. Buckup, MCN 5557); Viamão, Médio Arroio Pasqueiro, 30 May 2000, 1♀ (A. B. Bonaldo, MCN 33186); Viamão, Escola Irmãos Maristas, 20 May 1994, 1♂ (A. A. Lise et al., MCP 4786); 19 Aug. 1994, 1♂ (A. A. Lise et al., MCP 5299).

Mangora bocaina new species
Figures 177–185; Map 2G

Holotype. Female holotype and male paratype from Parque Nacional da Serra da Bocãina, Rio de Janeiro, Brazil, 14 May 1991 (N. Silveira), in MCN 21085. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma grayish yellow. Abdomen: whitish, dorsum with a posterior band containing some gray longitudinal lines and black transverse marks (Figs. 182, 183); venter without pigment spots except for a pair anterior white spots and lateral to spinnerets (Fig. 184); sides without pigment spots. Posterior eye row procurved. Ocular quadrangle as long as wide posteriorly, posterior widest. Posterior median eyes 1.4 diameters of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 1.0 diameter apart, 1.0 from laterals. Posterior median eyes 1.0 diameter apart, 1.2 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 2.7 mm. Carapace 1.3 mm long, 1.1 wide in thoracic region, 0.5 wide behind lateral eyes, 0.7 high. First femur 1.3 mm, patella and tibia 1.5, metatarsus 1.3, tarsus 0.5. Second patella and tibia 1.3 mm, third 0.8, fourth, 1.3.

Male paratype. Prosoma orange-yellow. Abdomen: dorsum with white pigment spots. Posterior eye row procurved. Ocular quadrangle slightly longer than wide, anterior widest. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.8 diameter apart, 0.4 from laterals. Posterior median eyes 0.7 diameter apart, 1.0 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 2.3 mm. Carapace 1.3 mm long, 1.2 wide in thoracic region, 0.4 wide behind lateral eyes, 0.7 high. First femur 1.3 mm, patella and tibia 1.4, metatarsus 1.2, tarsus 0.6. Second patella and tibia 1.3 mm, third 0.8, fourth, 1.2.

Males and females have been collected together.

Variation. Total length of females 2.5 to 3.8 mm, males 2.1 to 2.8. The smallest specimen is one from Mato Grosso and might belong to a different species. Some females have a depression lateral to the septum in ventral view of the epigynum (Fig. 179).

Diagnosis. The *M. bocaina* epigynum lacks the median swelling anterior to the triangular light area (Fig. 177) present in *M. fundo* (Fig. 170). In posterior view, *M. bocaina* has a narrow stalk extending ventrally from the median plate (Figs. 178, 179, 181), whereas *M. fundo* has the ventral end of the median plate wide (Fig. 171).

The male palpus differs from that of *M. fundo* (Fig. 176) by lacking the prominent median apophysis projection and having in its place a small hook (5 h in Fig. 185) and having a wide curved embolus (center of Fig. 185).

Natural History. Specimens were collected in cerrado-scrub in Mato Grosso.

Distribution. Mato Grosso, Brazil, and southern Brazil (Map 2G).

Specimens Examined. BRAZIL *Mato Grosso:* 260

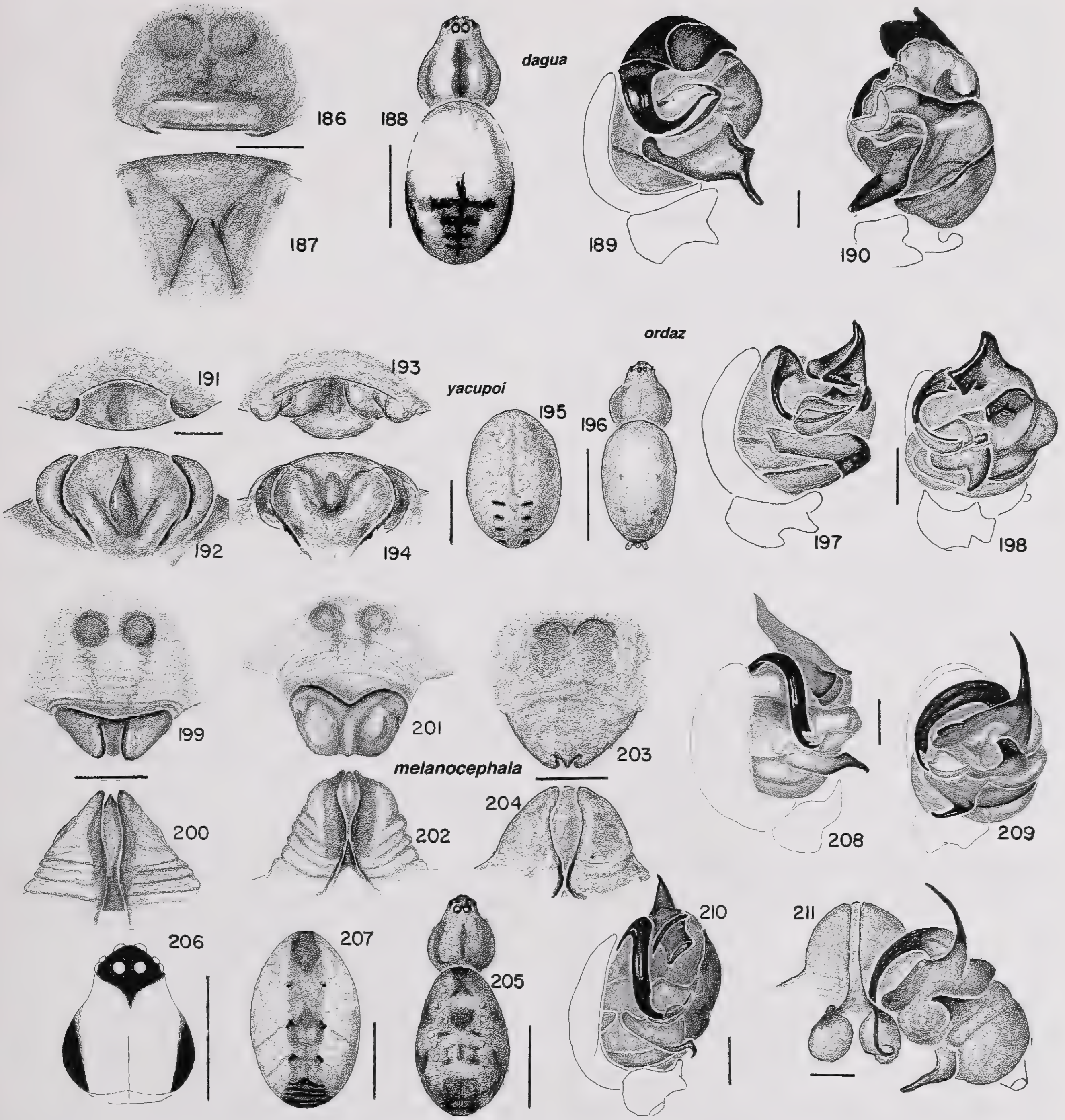
km N of Xavantina [Chavantina], 12°49′S, 51°46′W, 400 m, Feb.–Apr. 1969, 1♀ (Xavantina-Cachimbo Exped., MCZ). *Rio de Janeiro:* Mangaratiba, Feb. 1976, 1♀ (M. Alvarenga, AMNH); Teresópolis, 900–1,000 m, Mar. 1946, 1♀ (H. Sick, AMNH). *São Paulo:* Barueri, 9 Dec. 1961, 1♀ (K. Lenko, MZSP 7588); 8 Sep. 1965, 1♀ (K. Lenko, MZSP 4534); 3, 6 Dec. 1965, 3♀ (K. Lenko, MZSP 5874, 6883); São Miguel Arcanjo, Parque Estadual de Carlos Botelho, 14 Oct. 1990, 1♂ (A. B. Bonaldo, MCN 20475); Salesópolis, Estação Biológica de Boracéia, 10 Feb. 1942, 1♀ (MZSP 4815); 4 Apr. 1942, 2♀, 1♂ (B. Soares, MZSP 13243); 18 Oct. 1960, 1♀, 1♂ (K. Lenko. MZSP 13248); 22–23 Feb. 1961, 1♂ (P. de Biasi, MZSP 13247); 27, 28 July 1961, 4♀, 1♂ (P de Biasi, MZSP 13240); 18 Aug. 1966, 2♀, 3♂ (Dep. Zool., MSZP 15945); 28 Feb. 1967, 3♀, 1♂ (P. de Biasi, MZSP 15982); São Paulo, Campus IBSP, 12, 31 Aug. 1998, 1♀, 2♂ (F. S. Cunha, IBSP 19663, 19664, 19665); Embu-Guaçu, Cabeceiras do Rio Embu-Guaçu, Campos da Serra, 22 Sep. 1942, 1♀ (F. Lane, MZSP 13238); Carvalho de Araújo [?], 3 May 1942, 1♀ (A. Zoppei, MZSP 3239); Jundiaí, Nov. 1976, 8♀, 3♂ (P. A. Schneble, MCZ); 18–21 Apr. 1998, 1♀ (C. A. Rheims, IBSP 17455); 4–8 Mar. 2000, 1♂ (C. A. Rheims, IBSP 26232); Pindamonhangaba, 8–10 Apr. 1998, 1♀ (R. Martins, I. Knyzak); São Bernardo, 7 Feb. 1968, 1♀ (P. de Biasi et al., MZSP 8309); Cotia, Dec. 2002, 1♀ (H. Y. Yamaguti, MZSP); Salesópolis, 12 May 1961, 1♂ (K. Lenko, MZSP 13242); São Paulo, Água Funda, 16 Mar. 1961, 1♀ (H. Canter, MZSP 13244); São Paulo, Serra da Cantareira, 31 Aug. 1960, 1♂ (MZSP 13245); São Paulo, Mar. 1961, 2♀ (F. S. Cunha, IBSP 19661); 35 km S São Paulo, Camino do Mar, 11 Apr. 1965, 4♀, 1♂ (H. Levi, P. de Biasi, MCZ). *Paraná:* Curitiba, 2 May 1967, 2♀ (P. de Biasi, MZSP 7041); Almirante Tamandaré, Terra Boa, 5 Apr. 1987, 2♀ (A. D. Brescovit, MCN 16950); Almirante Tamandaré, 6 Apr. 1984, 3♀, 3♂; 25 Apr. 1984, 1♀, 1♂; 8 May 1984, 1♀, 1♂; 25 May 1984, 6♀, 3♂; 8 June 1984, 11♀; 22 June 1984, 1♀, 1♂; 10 July 1984, 1♀, 1♂; 5 Aug. 1984, 3♀; 8 Aug. 1984, 2♀, 2♂; 24 Aug. 1984, 1♂; 28 Sep. 1984, 1♂; 6 Oct. 1984, 3♂; 28 Oct. 1984, 1♀; 24 Aug. 1984, many ♀ (E. C. Costa, MCN 12387, 12391, 12399, 12406, 12413, 12420, 12425, 12433, 12436, 12441, 12442, 12446, 12453, 124767, 12473, 12484, 12489, 12498, 12506, 12516, 12512); Curitiba, Bom Retiro, 10 Apr. 1987, 1♀, 1♂ (A. D. Brescovit, MCN 16919); Morretes, Parque Estadual do Pico do Marumbi, 28 Mar.–25 Aug. 1996, 1♂ (J. A. Castano, IBSP 7329); Rio Azul, 2 Apr. 1993, 1♀ (R. Bóçon, MCN, 23607); Rio Branco do Sul, 16 Apr. 1987, 1♀ (A. D. Brescovit, MCN 17142). *Santa Catarina:* [?] June, 1♂ (J. P. Duret, MACN); Ilhota Morro do Baú, 13 May 1996, 2♀ (C. N. Duckett, MCN 27573); Porto Belo, 27 Oct. 1984, 1♂ (F. Z. da Cruz, MCN 12580); Bombinhas, Reserva Biológica Marinha do Arvoredo, Oct. 1993, 1♀ (L. Moura, MCP 4502). *Rio Grande do Sul:* Canela, 11 Jan. 1966, 1♀ (A. A. Lise, MCN 664); Capão Novo, 17, 18 Apr. 1993, 1♀ (A. A. Lise, MCP 3140); Guaíba, 29 Oct. 1994, 1♀ (A. Lise, MCP 5662); São Francisco de Paula, Potreiro Velho, 12–14 Nov. 1998, 1♂ (A. Lise, MCP 12698); Santo Antônio da Patrulha, Fazenda Paulo Lompra, 29°57′S, 50°37′W, 2 June 2000, 1♀ (A. B. Bonaldo, MCN 32970); Viamão, Morro do Côco, 25 July 1985, 1♀ (A. A. Lise, MCN 13376); 2 Dec. 1994, 1♀ (A. A. Lise et al., MCP 5907); Roca Sales, 24 May 1986, 1♀ (A. D. Brescovit, MCN 15102a); Tenente Portela, Parque Estadual do Turvo, Salto do Yucumã, 11 Sep. 1990, 1♀ (N. Silveira, MCN 19986); Torres, 8 May 1994, 1♂ (A. A. Lise, MCP 4837a); Torres, Colônia São Pedro, 7–9 June 1992, 1♂ (A. Braul, MCP 1983).

Mangora dagua new species
Figures 186–190; Map 1I

Holotype. Female holotype from Río San Juan, a tributary of Río Dagua near Queremal, 1300 m, Valle, Colombia, 25 July 1970 (W. Eberhard 308) in MCZ. The specific name is a noun in apposition after Río Dagua.

Description. Female holotype. Carapace yellowish with a wide, black, longitudinal median band and a smaller lateral band on each side (Fig. 188). Labium, endites, and sternum orange. Legs yellow with indistinct rings. Abdomen [in poor condition]: dorsum with a dark longitudinal posterior marking (Fig. 188). Posterior eye row procurved. Ocular quadrangle longer than wide, posterior widest. Posterior median eyes 2.0 diameters of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes their diameter apart, 1.0 from laterals. Posterior median eyes 0.2 diameter apart, 0.4 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length about 3.0 mm. Carapace 1.4 mm long, 1.2 wide in thoracic region, 0.7 wide behind lateral eyes, 0.7 high. First femur 1.4 mm, patella and tibia 1.6, metatarsus 1.4, tarsus 0.5. Second patella and tibia [lost], third 1.1. Fourth femur 1.7 mm, patella and tibia 1.7, metatarsus 1.6, tarsus 0.5.

Male paratype. Coloration as in female. Posterior eye row procurved. Ocular quadrangle as long as wide posteriorly, posterior widest. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 0.8 diameter apart, 1.2 from laterals. Posterior



Figures 186–190. *Mangora dagua* new species. 186–188, female. 186, 187, epigynum. 186, ventral; 187, posterior. 188, carapace, abdomen. 189, 190, left male palpus. 189, mesal; 190, ventral.

Figures 191–195. *M. yacupoi* new species, female. 191–194, epigynum. 191, 193, ventral; 192, 194, posterior. 195, abdomen.

Figures 196–198. *M. ordaz* new species, male. 196, carapace, abdomen. 197, 198, male palpus. 197, mesal; 198, ventral.

Figures 199–211. *M. melanocephala* (Taczanowski). 199–207, female. 199–204, epigynum. 199, 201, 203, ventral; 200, 202, 204, posterior. 205, carapace, abdomen. 206, carapace. 207, abdomen, dorsal. 208–211, male palpus. 208, 210, mesal; 209, ventral; 211, epigynum with inserted embolus of male palpus.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

median eyes 0.4 diameter apart, 0.4 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Total length about 2.3 mm. Carapace 1.2 mm long, 0.9 wide in thoracic region, 0.4 wide behind lateral eyes, 0.6 high. First femur 1.4 mm, patella and tibia 1.3, metatarsus 1.2, tarsus 0.6. Second patella and tibia 1.1 mm, third 0.7, fourth 1.2.

Male and female were collected in different years from the same locality.

Diagnosis. Mangora dagua has the epigynum lightly sclerotized (Figs. 186, 187) and is distinguished from others by the hour-glass–shaped median plate in posterior view (Fig. 187).

The male palpus is distinguished from others by the thick, U-curved embolus (center of Fig. 189) and a median apophysis with a prong extending from its side (4 h in Fig. 189, 8 h in Fig. 190).

Distribution. Southwest Colombia (Map 1I)

Paratypes. COLOMBIA *Valle:* Río San Juan, a tributary of Río Dagua near Queremal, 1,300 m [date?], 1♂ (W. Eberhard, MCZ).

Specimens Examined. No other specimens have been found.

Mangora yacupoi new species
Figures 191–195; Map 2D

Holotype. Female holotype and two paratypes from Río Urugu-í, Yacú-Poi, 30 km from Puerto Bemberg [Puerto Libertad], Misiones, Argentina, Jan.–Feb. 1950 (A. Giai, W. Partridge), in MACN 3173. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellow. Abdomen: dorsum with white pigment spots, with five pairs of posterior black bars, the most posterior one very short (Fig. 195); venter with a few white pigment spots. Posterior eye row straight. Ocular quadrangle wider than anterior width, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 0.8 diameter apart, 0.8 from laterals. Posterior median eyes 0.5 diameter apart, 1.2 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 3.2 mm. Carapace 1.3 mm long, 1.2 wide in thoracic region, 0.5 wide behind lateral eyes, 0.7 high. First femur 1.5 mm, patella and tibia 1.9, metatarsus 1.4, tarsus 0.7. Second patella and tibia 1.7 mm, third 1.0, fourth 1.7.

The male is not known.

Illustration. Figures 191, 192, 195 were made from the holotype.

Diagnosis. Mangora yacupoi epigynum (Figs. 191–194) is lightly sclerotized and differs from that of *M. melanoleuca* (Figs. 241, 242) by the wider, shallower median plate (Figs. 191–194) and by lacking bands on the abdomen (Fig. 195).

Distribution. Northeastern Argentina (Map 2D).

Specimens Examined. ARGENTINA *Misiones:* Santa María, Nov., Dec. 1956, 3♀ (M. J. Viana, MACN 3593, 3595).

Mangora ordaz new species
Figures 196–198; Map 2A

Holotype. Male holotype from 15 km SW Puerto Ordaz, Bolívar, Venezuela, 13 July–2 Aug. 1987 (S. and J. Peck), in AMNH. The specific name is a noun in apposition after the type locality.

Description. Male holotype. Prosoma orange, with a gray band on each side of carapace (Fig. 196). Abdomen: whitish, dorsum with posterior, paired gray marks (Fig. 196); venter with indistinct gray marks on sides. Posterior eye row procurved. Ocular quadrangle longer than wide, rectangular. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 1.0 diameter apart, 0.7 from laterals. Posterior median eyes 0.5 diameter apart, 1.0 from laterals. Height of clypeus equals 0.3 diameter of anterior median eyes. Fourth femur with a ventral, proximal macroseta. Total length 2.0 mm. Carapace 0.9 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.5 high. First femur 1.0 mm, patella and tibia 1.2, metatarsus 0.8, tarsus 0.5. Second patella and tibia 1.0 mm, third 0.6, fourth 1.0.

The female is not known.

Diagnosis. The palpus of *M. ordaz* differs from that of *M. dagua* (Figs. 189, 190) by having the median apophysis with a distal bend (4 h in Fig. 197, 6 h in Fig. 198) and a thinner embolus (center of Fig. 197, 9 h in Fig. 198).

Distribution. Only known from Venezuela (Map 2A).

Specimens Examined. No other specimens have been collected.

Mangora melanocephala (Taczanowski)
Figures 2, 21, 199–211; Map 2F

Linyphia melanocephala Taczanowski, 1874: 70. Male and female syntypes from Cayenne, French Guiana, in PAN, examined.

Zilla melanocephala:—Keyserling, 1881: 552, pl. 16, fig. 4, ♀♂; 1893: 302, pl. 15, fig. 223, ♀♂.

Mangora picta:—O. P.-Cambridge, 1889: 14, pl. 3, fig. 6, ♀; F. O. P.-Cambridge, 1904: 479, pl. 45, ♀. (Female only, but not male holotype.) Error first noted by Chickering, 1954.

Mangora spinula F. O. P.-Cambridge, 1904: 480, pl. 45, fig. 18, ♂. Male holotype from Teapa, Mexico, in BMNH; Chickering, 1954: 211, figs. 23–26, ♀♂. Synonymized by Levi, 2005.

Mangora dentembolus Chamberlin and Ivie, 1936: 59, pl. 12, figs. 114–116, ♂. Male holotype from Barro Colorado Island, Panama, in AMNH; vial examined, but specimen lost. Synonymized with *M. spinula* by Chickering, 1954.

Zygiella melanocephala:—Roewer, 1942: 887.

Mangora aragarcensis Soares and Camargo, 1948: 372, figs. 27, 28, ♀. Female holotype from Aragarças, Goiás, Brazil, in MZSP no. 1215, examined. Platnick, 2005. Synonymized by Levi, 2005.

Mangora melanocephala:—Caporiacco, 1948: 659; Levi, 2005: 151, figs. 30–47, ♀♂; Platnick, 2006.

Mangora pozonae Schenkel, 1953: 20, fig. 18, ♀. Female holotype from Conwarook (Potaro), Pozón [Falcón], Venezuela, in the NHMB, examined. Synonymized by Levi, 2005.

Note. Taczanowski did not illustrate the specimen, but Keyserling apparently examined and described the syntypes and illustrated the genitalia.

Description. The species has recently been redescribed (Levi, 2005). Total length 2.7 mm. Carapace 1.2 mm long, 1.0 wide in thoracic region, 0.6 wide behind lateral eyes, 0.7 high. First femur 1.5 mm, patella and tibia 1.7, metatarsus 1.4, tarsus 0.6. Second patella and tibia 1.5 mm, third 0.9, fourth 1.7.

Male. Total length 1.8 mm. Carapace 1.1 mm long, 0.9 wide in thoracic region, 0.4 wide behind lateral eyes, 0.6 high. First femur 1.2 mm, patella and tibia 1.5, metatarsus 1.2, tarsus 0.7. Second patella and tibia 1.4 mm, third 0.8, fourth 1.3.

Variation. Total length of females from South America 2.7 to 3.5 mm, males 1.8 to 2.7. Colombian specimens are slightly larger, some females to 4.3 mm, males 2.3. The epigynum is lightly sclerotized and the posterior rim variable in shape (Figs. 199, 201, 203). Some Colombian specimens are light and do not have a black cephalic region, but have a black patch on each side of the carapace. Several specimens from Depto. Santander, Colombia, had an epigynum with the median plate wide in ventral view and pulled out; males lack the characteristic break in the embolus, and the terminal apophysis short (Fig. 210). Two Ecuadorian specimens are light, whereas the third is very dark and has a black cephalic region as in the syntypes (Fig. 206). The spacing of eyes may differ slightly: southern Brazilian specimens have the eyes a little farther apart than those from Panama and have the legs shorter. A male from Puerto Maldonado, Peru, lacked the characteristic black patches on the carapace and also the macroseta on the fourth leg.

The illustrations in Figures 2, 199, 200, 206, 208, 209 were made from syntypes of *M. melanocephala*; Figures 201, 202 from Tumbes Prov., Peru; Figures 203, 204, 205 from Misiones Prov., Argentina, and Figure 210 from a specimen from Colombia. Figure 211, insertion of the embolus into the epigynum, is from specimens from Panama.

Diagnosis. Mangora melanocephala has a black or gray band on the sides of the carapace, sometimes barely visible (Figs. 205, 206). The epigynum is lightly sclerotized and is distinguished from others by having the spermathecae placed far anterior (Figs. 199, 201, 203), and in posterior view by the narrow median plate and wide triangular, striated lateral plates (Figs. 200,

202, 204). The posterior rim of the epigynum in ventral view is variable (Figs. 199, 201, 203).

Males have black or gray bands on the sides of the carapace (Figs. 205, 206), a macroseta on the fourth femur (Fig. 21). The palpus is distinguished by the long wide embolus that appears broken near its tip (center of Fig. 208), and the spine-shaped projection of the terminal apophysis (12 h in Figs. 208, 210, 2 h in Fig. 209).

Natural History. This is the most common and widespread species of *Mangora* in South America. It has been collected in various habitats: banana plantation, yucca plantation, coffee plantation, pasture, sweeping grasses, meadow, herbs and vegetation on river shore, dead foliage, forest border, forest ravine, sweeping forest floor, and rainforest.

Distribution. From Veracruz, Mexico, to northern Argentina (Map 2F).

Specimens Examined. Mexican and Central American records are cited in Levi (2005).

VENEZUELA *Sucre:* Nueva Esparta, Isla Margarita, Cerro Copey, 900 m, 13 Jan. 1984, 10 Feb. 1984, ♀ (J. Coddington, USNM). *Monagas:* Caripito, Aug. 1942, ♀♂ (W. Beebe, AMNH); Caripe Cueva Guacharo, 750 m, 20–31 July 1987, ♀ (S. and J. Peck, AMNH). *Guárica:* Guatopo Natl. Park, Río Orituco, 24 km N Altagracia, 13 June 1987, ♀♂ (S. and J. Peck, AMNH). *Miranda:* 28 km N Altagracia, Guatopo Natl. Pk., 700 m, El Lucero, 14 June 1987, ♀♂ (S. and J. Peck, AMNH). *Aragua:* Rancho Grande nr. Maracay, 24 Aug. 1946, ♀ (W. Beebe, AMNH). *Carabobo:* San Esteban, 26 Jan. 1940, ♀♂ (P. Andruze, AMNH). SURINAME Moengo, 160 km up Cottica River, Aug. 1932, ♀ (G. Damback, AMNH). FRENCH GUIANA slopes of Mt. Mahury nr. Cayenne, 12–14 Dec. 1972, ♀ (D. Quintero, MCZ); Cayenne [1866–1871], ♀ (K. Jelski, PAN). COLOMBIA *Magdalena:* San Pedro, Sierra Nevada de Santa Marta, 1,300 m, Feb. 1974, May 1975, ♀♂ (J. A Kochalka); Carmelio, Sierra Nevada de Santa Marta, 1,400 m, Feb. 1974, ♀ (J. A. Kochalka); above Minca Valley, Sierra Nevada de Santa Marta, Feb. 1974, ♀ (J. A. Kochalka); Serr. Nueva Granada, Sierra Nevada de Santa Marta, 1,600 m, 28 May 1975, ♀ (J. A. Kochalka); Cisneres Río Quebrada Descansion, 15 Dec. 1969, ♀♂ (MCZ); Cañaverales, Tayrona Park, ca. 40 km E Sta. Marta, 11 Aug. 1985, ♀ (H.-G. Müller, SMF); Río Don Diego, ca. 70 km E Sta. Marta, 25 March 1986, ♀♂ (H.-G. Müller, SMF); Sierra Nevada de Santa Marta, nr. San Pedro de la Sierra, 1,000 m, 12 Aug. 1986, ♀♂ (H.-G. Müller, SMF). *Santander:* Suaita, San José de Suaita, 1,800 m, 6–9 Oct. 1998, ♀♂ (E. Florez, Estud.. de Sistem. Animal, ICNB AR-1588, 1592 1593); Guadalupe, Vda. Solferina, Finca Maravilla, 1,800 m, 9 Oct. 1998, ♀ (E. Florez, Estud. de Sistem. Animal, ICNB AR-1591). *Antioquia:* Medellín, 1,700 m, June 1963, ♂ (P. B. Schneble, MCZ); Mutatá, June, July, Dec. 1963, ♀ (P. B. Schneble, MCZ). *Meta:* Pto. Lleras, Lomalinda, 03°18′N, 73°22′W, 10 Jan. 1986, Apr. 1986, Aug. 1988, Feb. 1989, ♀♂ (B. T. Carroll, MCZ, CAS); Carimagua, Oct. 1973, ♀ (W. Eberhard 628, MCZ); 6 km SW Puerto Lopez, 1978, ♀ (W. Eberhard 1415, MCZ); 15 km SW Puerto Lopez, Hacienda Mozambique, 200 m, 1978, ♀♂ (W. Eberhard 1467, 1468, 1472, 1501, 1508, 1590 1641, MCZ); ca. 20 km N Río Muco, ca. 20 km S El Porvenir, Finca Chenovo, 1978, ♀♂ (W. Eberhard 1344, 1349, 1351, 1353, 1355, 1358 1363, 1365, 1366, 1397, 1399, 1401, MCZ); Villavicencio, Aplay, 450 m, Oct. 2003, ♀ (E. Florez, ICNB AR-2985). *Cundinamarca:* Monteredondo, 1,200 m, 25 Feb. 1975, ♀♂ (P. B. Schneble, MCZ); Villetta, 800 m, 8 Sep. 1973, ♀♂ (P. B. Schneble, MCZ); ca. 4.8 km SE Finca Bella Vista W of Sasaima, 13 May 1965, ♂ (P. R., D. L. Craig, CAS). *Risaralda:* Santa Cecilia, Granja Secretaría de Agricultura, 600 m, Oct. 1991, ♀ (Curso Arañas ICN-UNAL, ICNB AR-132, 159, 161, 630); Mistrato, San Antonio del Chami, Albania, 1,400 m, 5 May 1992, ♀ (Est. Biol., UN ICNB AR-1589). *Chocó:* Quebrada Docordo betw. Cucurrupi and Noanama, Río San Juan, 5 Jan. 1969, ♂ (B. Malkin, AMNH). *Valle:* Anchicaya, 26 Oct. 1969, 1 July 1972, 1977, ♀♂ (W. Eberhard 61, 94, 418, MCZ); Buenaventura, 4 Nov. 1950, ♀♂ (E. S. Ross, CAS); Jan. 1970; Mar. 1973, ♀ (W. Eberhard 3, 208p, 224, 503, MCZ); 50 km S Buenaventura, Mar. 1973, ♀♂ (W. Eberhard, MCZ); Queremal to Buenaventura, 17 Feb. 1935, ♀ (H. F. Schwarz, AMNH); Cali, 1973, 1974, ♀♂ (W. Eberhard 467, 535, MCZ); 30 Dec. 1976, ♀ (H. Levi, MCZ); Río Jamundi, betw. Cali & Jamundi, 9 July 1969, 17 June 1970, 13 June 1972, ♀♂ (W. Eberhard 156, 156p, 263, 266, MCZ). *Huila:* Tierra a Dentro, ca. Tanzá, Aug. 1971, ♀ (W. Eberhard, MCZ). *Cauca:* NW of Guapi, Jan. 1973, ♀ (W. Eberhard, MCZ). *Putumayo:* Buena Vista, 23–29 July 1972, ♀ (W. Eberhard, MCZ); El Pepino [01°03′N, 76°38′W], 21 Feb. 1973, ♀♂ (N. Leist, IBSP 10769). *Nariño:* road to Barbacoas, Mar. 1974, ♀ (W. Eberhard, 752, MCZ); La Planada, 1,800 m, 7 km S Chocones, 9 km S Ricaurte, July 1986, June 1991, ♀♂ (W. E. Eberhard, MCZ). *Vaupés:* Mitú, 200 m, Feb. 1975, ♀♂ (P. B. Schneble, MCZ); 9–15 July 1990, ♀ (L. E. Peña, AMNH). *Amazonas:* Leticia, 20 Jan. 1965, ♀ (CAS); Río Pira and Apaporis, 0°25′S, 70°15′W, 16 Feb. 1989, ♀ (V., B. Roth, CAS). ECUADOR *Napo:* Alinahui, 20 km E Puerto Napo, Oct. 1994, ♀ (V., B. Roth, CAS); Misahualli, 21 Mar. 1971, ♀♂ (R. A. Sweet, AMNH); Bumbaini-yacu [?], 900 m, Apr. 1941, ♀♂ (W. Clarke-Macintyre, AMNH); Huagra-yacu [?], Apr. 1941, ♀♂ (W. Clarke-Macintyre,

AMNH); headwaters of Río Arajuno, 1,000 m, Napo watershed, 28 Apr. 1941, ♀♂ (W. Clarke-Macintyre, AMNH); Coca River, Napo River, 24–30 April 1965, ♀ (L. Peña, MCZ); Rio Topo, 17 June 1943, ♀♂ (D. L. and H. E. Frizzell, CAS). *Pastaza:* Puyo, 900 m, Mar. 1941, ♀ (W. Clarke-Macintyre, AMNH); Río Puyo, 900 m, Mar.–Apr. l941, ♀♂ (W. Clarke-Macintyre, AMNH); 12 km W Puyo, 5 Feb. 1976, ♀ (P. Spangler, USNM). *Pichincha:* 7 km SE Mindo, 16 Apr. 1994, ♂ (V., B. Roth, CAS); km 113 Via Pto. Quito, 1 Oct. 1984, ♂ (L. Avilés, MECN); 1989, ♂ (L. Avilés, MECN); 28 Aug. 1989, ♀, 28, 29 Sep. 1989, ♀ (L. Avilés, MECN); 1 Oct, 1989, ♀♂ (L. Avilés, MECN); 10 km W Santo Domingo de los Colorados, 23 Feb. 1955, ♀♂ (E. I. Schlinger, E. S. Ross, CAS); 47 km S Santo Domingo, Río Palenque, 5 June–25 July 1985, ♀ (S. and J. Peck, AMNH); 35 km NW Santo Domingo, 22 Dec. 1958, ♀ (A. M. Nadler, AMNH); 16 km SE Santo Domingo, Tinalandia, 680 m, 15–30 June 1975, ♀♂ (S. and J. Peck, MCZ); Tinalandia, ca. 2,830 m, 12 km E Santo Domingo de los Colorados, 11–17 May 1986, ♀♂ (G. B. Edwards, FSCA). *Esmeraldas:* Bilse nr. Herrera, 6–9 Feb. 1994, ♂ (V. Roth, CAS). *Chimborazo:* Yanaurcu, 300 m, 20–30 Aug. 1977, ♀♂ (L. Peña, AMNH). *Bolívar:* Balzapamba, 700 m, May–June 1938, ♀♂, June 1939, ♀♂ (W. Clarke-Macintyre, AMNH). *Los Ríos:* Playas de Montalvo, 15 m, 18 Apr. 1938, ♂ (W. Clarke-Macintyre); Juan Montalvo, Mar. 1938, 15 m, ♀ (W. Clarke-Macintyre, AMNH); Pichilinque, 3 Feb. 1955, ♀ (E. I. Schlinger, E. S. Ross, CAS). *Manabi:* on road betw. Crucita and Charapoto, 0°52′S, 80°31′W, 29 Aug. 1988, ♂ (W. Maddison, MCZ). *Morona-Santiago:* Los Tayos, Santiago, 03°04′S, 78°02′W, 3 Aug. 1976, ♀ (N. Engler, MCZ). *Guayas:* Guayaquil, 8 Mar. 1942, ♀ (H. D. Frizzell, CAS). *Azuay:* Tarqui, 10 Feb. 1976, ♀♂ (P. Spangler, USNM). *Zamora-Chinchipe:* Zamora, 4 Apr. 1965, ♀♂ (L. Peña, MCZ); Jamboé River [Jumbué], 1 June 1965, ♀♂ (L. Peña, MCZ); Prov. Zamora, 5 June 1976, ♀ (A. Langley et al., USNM). PERU *Loreto:* Yurimaguas Agric. Exp. Station, 9 Aug. 1974, ♂ (B. Patterson, MCZ); Explorama Lodge, 80 km NE Iquitos, 16–20 July 1989, ♀ (G. B. Edwards, FSCA); Río Manatee, 18 July 1989, ♀ (G. B. Edwards, FSCA). *Amazonas:* Cordillera del Cóndor, alto Río Comaina, Puesto de Vigilancia 22, 850–1,150 m, 24 Oct. 1987, ♀♂ (D. Silva D., MUSM). *Piura:* Mallares, 7 Dec. 1941, ♀ (D. L. and H. E. Frizzell, CAS); 6 km W Sullana, 5 Oct. 1941, ♀ (D. L. and H. E. Frizzell, CAS). *Lambayeque:* Lechugal [Río Zarumilla, NW], Mar. 1876, ♀ (J. Sztolcman, PAN). *Huánuco:* Monzón Valley, Tingo María, 18 Dec. 1954, ♀ (E. I. Schlinger, E. S. Ross, CAS); Aguaytía, Boqueron del Padre Abad, ca. Cascada "Velo de novia", 29 July 1986, ♀ (D. Silva D., MUSM). *Pasco:* Puerto Bermúdez, Río Pechis, 12–19 Jul. 1920, ♀ (CUC). *Lima*(?): San Juan, 23 June 1920, ♀♂ (CUC). *Junín:* Amable María [Prov. Tarma, 640 m, on Río Chanchamayo], ca. 1870–1875, ♀ (K. Jelski, PAN); Maraynioc, ♀ (?K. Jelski, PAN). *Madre de Dios:* Puerto Maldonado, 300 m, 16–23 April 1947, ♂ (J. C. Pallister, AMNH). *Cuzco:* Quincemil, 24–27 Apr. 1947, ♀ (J. C. Pallister, AMNH). *San Martín:* Mishqui-yacu, 1,600 m, 20 km NE Moyobamba, Aug. 1947, ♀ (F. Woytkowski, AMNH). BRAZIL *Pará:* Santarém, Alter do Chão, 26 Jan. 1994, ♀ (H. Höfer, MCN 25293); Belém, July 1971, ♀ (T. McGrath, MCZ); Tucuruí, July 1989, ♀ (IBSP, IBSP staff, 5951); Jacareacanga, Dec. 1968, ♀ (M. Alvarenga, AMNH). *Roraima:* Rio Surumu, Oct. 1966, ♀ (M. Alvarenga, MZSP 6193). *Amazonas:* Parque Nacional da Neblina, 12 Oct. 1990, ♀ (A. A. Lise, MCP); Manaus, Reserva Florestal Adolpho Ducke, 3 Apr. 1990, ♀♂ (J. Vidal, MCN 19879); ca. 80 km N of Manaus, Dimona Reserve, 1989–1992, ♀ (H. G. Fowler, INPA); 80 km N Manaus, Colosso Reserve, 20 Dec. 1989, ♀ (H. G. Fowler et al., HGF); Fonte Boa, Sep. 1975, ♀♂ (M. Oliveira, AMNH). *Goiás:* Minaçu, Usina Hidroelétrica Serra da Mesa, 13°45′S, 41°50′W, 1–10 Nov. 1996, ♂ (A. Bonaldo, L. Moura, MCN 27832). *Mato Grosso:* Santo Antônio de Levergere, 29 July 1992, ♀ (A. A. Lise, A. Braul, MCP 2396a). *Espírito Santo:* Santa Teresa, 5 Oct. 1942, ♀ (B. Soares, MZSP 3257). *Minas Gerais:* Lavras, 7, 29 Mar. 1979, ♀♂ (W. Don Fronk, MCZ); Belo Horizonte, 1–6 Nov. 1919, ♀♂ (Cornell Univ. Exped., CUC). *Rio de Janeiro:* Angra dos Reis, 20 July 1966, ♀♂ (P. Monto, MZSP 5139); Niteroi, 25 Aug. 1961, ♀ (P. de Biasi, MZSP 3260); Ilha Grande, Enseada das Palmas, Praia Grande das Palmas, 19–21 Jan. 1999, ♂ (M. Ramírez, MACN); Rio de Janeiro, Dec. 1970, Jan. 1971, ♀ (D. McGrath, S. M. Camazine, MCZ); Serra dos Orgãos, 1,500 m, 20 Apr. 1965, ♂ (H. Levi, MCZ); Silva Jardim, Aug. 1975, ♀♂ (M. Alvarenga, AMNH); Mangaratiba, Muriqui, Feb. 1976, ♀♂, Oct. 1961, ♀ (M. Alvarenga, AMNH); Represa Rio Grande, Feb. 1976, ♀ (M. Alvarenga, AMNH); Rio de Janeiro, ♂ (H. Reinhardt, ZMUC); Paineiras, May, Aug. 1961, ♀♂ (M. Alvarenga, AMNH); Parque Nacional da Tijuca, Floresta dos Macacos, Feb. 1961, ♀♂ (M. Alvarenga, AMNH); Mata da Cicuda, Volta Redonda, 18 Mar. 2000, ♀♂ (F. S. Cunha, IBSP 26314); Parque Nacional do Itatiaia, 1,200 m, 19–20 Mar. 1960, ♂ (B. Malkin, AMNH); Represa Rio Grande, Feb. 1976, ♀♂ (M. Alvarenga, AMNH). *São Paulo:* Cajurú, Fazenda São Geraldo, May 1944, ♀ (MZSP 13258); Nova Europa, 18, 19 June 1965, ♀ (K. Lenko, MZSP 4778, 5322); Santos, 29 Jan. 1961, ♀♂ (P. de Biasi, MZSP 13261); São Sebastião, 3 June 1961, ♀ (K. Lenko, MZSP 13259); Pindamonhangaba, 8–10 Apr. 1998, ♀♂ (R. Martins, I. Kynzak, IBSP 20043); Rio Claro, 1♂ (MNRJ 4186). *Paraná:* Cruzeiro do Oeste, Mata do Copel, Barragem do Chopinzinho, 24 Feb. 1993, ♀ (A. B. Bonaldo, MCN 23151); Cruzeiro do Iguaçu/Dois Vizinhos, Represa do Foz do Chopin, 15 Oct. 1998, ♀ (IBSP staff, IBSP 21139, 21171); Morretes, 26 Apr. 1987, ♀ (S. F. Coron, MCN 16990); Morretes, Serra da Graciosa, 9–20 Jan. 1995, ♀♂ (Lab. Arachnol., MCP 7041, 7079, 7424); Capitão Leonidas Marques, Represa de Salto Caxias, Rio Iguaçú, 20–28 Mar. 1993, ♀♂ (A. B. Bonaldo, MCN

23305, 23303); Três Barras do Paraná, Rio Guarani (Foz do Córrego Três Barras); 20–26 Feb. 1993, ♀♂ (A. B. Bonaldo, MCN 23023); Foz do Iguaçu, Parque Nacional do Iguaçú, 22–24 Mar. 1985, ♀♂ (H., L. Levi, MCZ). *Rio Grande de Sul:* Jacutinga BR 283, 6 Nov. 1996, ♀ (Itá Machadinho Group, MCP 11093); Marcelino Ramos Estreito Augusto Cesar, 3 Feb. 1990, ♀ (G. A. Martinazzo, MCN 19546); Estrela Velha, 1 Sep. 1977, ♀♂ (E. H. Buckup, MCN 6449); 6 May 1998, ♀♂ (M. A. L. Marques, MCN 29363); 20 Oct. 1998, ♀ (A. Velha, MCN 29559); Iraí, 19 Nov. 1975, ♀ (A. A. Lise, MCN 3063); Arroio do Tigre, Itaúba, 17 Apr. 1978, ♀ (A. A. Lise, MCN 7995); Lageado, 20 Apr. 1974, ♀ (A. A. Lise, MCN 1985); Triunfo, 20 Oct. 1977, ♀♂ (H. Bischoff, MCN, 6882); 27 Oct. 1977, ♀♂ (M. H. Galileo, MCN 6998); Gravataí, 15 Mar. 1999, ♀♂ (M. A. L. Marques, MCN 30565); Ita, Rio Uruguai, Represa de Itá Machadinho, 1 Oct. 1988, ♂ (A. A. Lise, MCP 811); Montenegro, 1 Sep. 1977, ♀♂ (H. Bischoff, MCN 6423); 15 Dec. 1977, ♀ (H. Bischoff, MCN 7515); Montenegro, 11 Aug. 1977, ♀ (E. H. Buckup, MCN 6240); 29 Sep. 1977, ♀ (H. A. Gastal, MCN 6697); 6 Oct. 1977, ♀ (H. A. Gastal, MCN 6750); Muçum, 2 Mar. 1984, ♀ (A. D. Brescovit, MCN 12115); Rio Jacutinga, Br. 283, Represa de Itá-Machadinho, ♂ (A. A. Lise, MCP 6458); Triunfo, Parque Copesul Proteção Ambiental, 5 July 2000, ♂ (E. H. Buckup, MCN 32511); 23 May 2000, ♀ (M. A. L. Marques, MCN 32329); 5 Jan. 2001, ♂ (M. A. L. Marques, MCN 33560); Roca Sales, 24 May 1986, ♀ (A. D. Brescovit, MCN 15102a); Tenente Portela, 11 Sep. 1946, ♀♂ (S. Scherer, MCN 4632); Triunfo, 19 May 1977, ♀ (E. H. Buckup, MCN 5397); 15 Sep. 1977, ♀ (A. A. Lise, MCN, 6534); 15 Oct. 1980, ♀ (H. E. Buckup, MCN 9240); 23 Apr. 1987, ♀ (M. A. L. Marques, MCN 16783); June 1987, ♀ (M. A. L. Marques, MCN 16860); 25 Jan. 1990, ♀ (A. M. Brescovit, MCN 19393); 12 June 1991, ♀ (M. H. M. Galileo, MCN 21155); Viamão, Águas Belas, 13 Sep. 1984, ♂ (A. A. Lise, MCN 12328); Viamão (many collections). PARAGUAY St. Louis [? San Luis], Oct. 1908, ♀ (AMNH). BOLIVIA *La Paz:* Guanay, N La Paz, 19–15 Aug. 1989, ♀ (L. E. Peña, AMNH). ARGENTINA *Misiones:* Parque Nacional Iguazú, Oct. 1953, ♀ (R. D. Schiapelli et al., MACN 3885); Santa María, Oct. 1956, ♂ (J. M. Viana, MACN); Puerto 17 de Octubre [Puerto Libertad], Oct. 1953, ♀ (De Carlo, R. D. Schiapelli, J. M. Viana, M. E. Galiano, MACN); Eldorado, 26°28′S, 54°43′W, 1 Sep.–15 Nov. 1964, ♀♂ (A. Kovacs, AMNH).

Mangora saut new species
Figures 212–215; Map 1H

Holotype. Female holotype from Petit Saut, north of Plomb, Fleure Sinamary, 05°07′N, 53°05′W, French Guiana, Oct. 1989 (E. Nancé), in MCZ. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellow; legs darker. Abdomen: dorsum yellowish with white pigment spots and pairs of posterior transverse gray bars (Fig. 215); venter with white spots on each side. Posterior eye row slightly procurved. Ocular quadrangle slightly wider than long, anterior widest. Legs are relatively heavy and carapace very high. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.6 their diameter apart, 0.6 from laterals. Posterior median eyes 0.4 their diameter apart, 0.8 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 3.6 mm. Carapace 1.6 mm long, 1.3 wide in thoracic region, 0.6 wide behind lateral eyes, 0.9 high. First femur 1.7 mm, patella and tibia 1.8, metatarsus 1.3, tarsus 0.7. Second patella and tibia 1.7 mm, third 1.1. Fourth femur 1.7 mm, patella and tibia 1.8, metatarsus 1.1, tarsus 0.6.

The male is unknown.

Diagnosis. Mangora saut epigynum is a projecting shelf (Fig. 214), but shorter than that of *M. brokopondo* (Fig. 139); the posterior side differs in having a slight anteromedian depression and almost straight, transverse dorsal slits (Fig. 213); also, specimens of *M. saut* are lighter in

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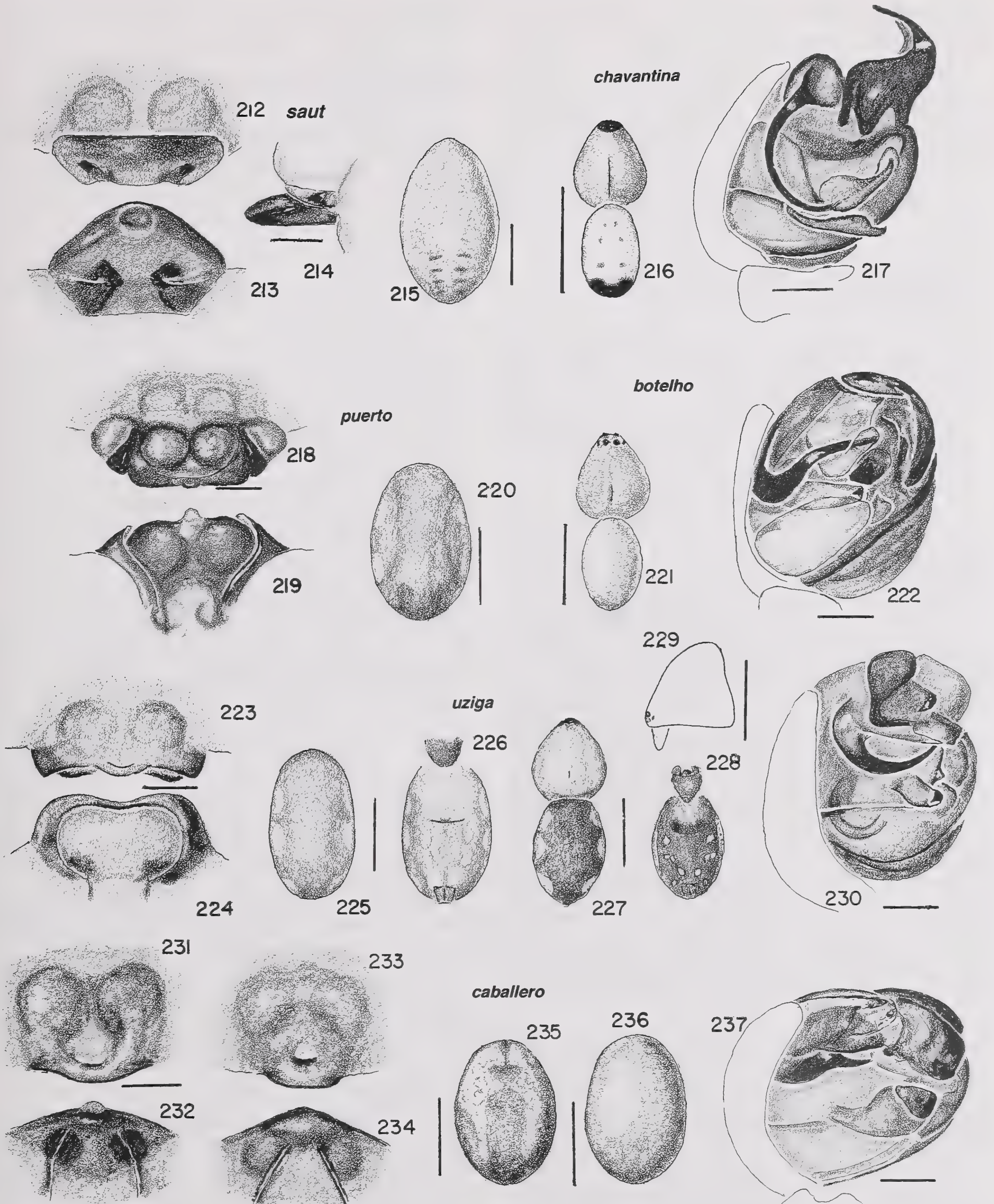
Figures 212–215. *Mangora saut* new species, female. 212–214, epigynum. 212, ventral; 213, posterior; 214, lateral. 215, abdomen, dorsal.

Figures 216, 217. *M. chavantina* new species, male. 216, carapace, abdomen. 217, left palpus, mesal.

Figures 218–220. *M. puerto* new species, female. 218, 219, epigynum. 218, ventral; 219, posterior. 220, abdomen, dorsal.

Figures 221, 222. *M. botelho* new species, male. 221, carapace, abdomen. 222, palpus, mesal.



Figures 223–230. *M. uziga* new species. 223–226, female. 223, 224, epigynum. 223, ventral; 224, posterior. 225, abdomen, dorsal. 226, sternum, abdomen. 227–230, male. 227, carapace, abdomen. 228, sternum, abdomen. 229, carapace, lateral. 230, palpus, mesal.

Figures 231–237. *M. caballero* new species. 231–236, female. 231–234, epigynum. 231, 233, ventral; 232, 234, posterior. 235, 236, abdomen, dorsal. 237, male palpus, mesal.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

color (Fig. 215) than those of *M. brokopondo* (Fig. 140).

Natural History. The holotype was found by beating canopy.

Distribution. Only known from French Guiana (Map 1H).

Specimens Examined. No other specimens were found.

Mangora chavantina new species
Figures 216, 217; Map 2D

Holotype. Male holotype from 260 km N Xavantina [Chavantina], 12°49′S, 51°46′W, 400 m, in campo-grasslands, Mato Grosso, Brazil, Feb.–Apr. 1969 (Xavantina-Cachimbo Exped.), in MCZ. The specific name is a noun in apposition after the type locality.

Description. Male holotype. Prosoma grayish orange. Abdomen: dorsum with black posterior (Fig. 216); venter without markings, spinnerets gray. Posterior eye row straight. Ocular quadrangle slightly longer than wide, rectangular. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 1.0 diameter apart, 0.8 from laterals. Posterior median eyes 0.8 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Small coxal hook present. Total length 1.7 mm. Carapace 0.8 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.3 high. First femur 1.0 mm, patella and tibia 1.2, metatarsus 0.7, tarsus 0.5. Second patella and tibia 1.0 mm, third 0.7, fourth 1.0.

The female is not known.

Diagnosis. Mangora chavantina palpus differs from that of *M. ordaz* (Fig. 197) by having a longer embolus (Fig. 217) and a larger, projecting, hook-shaped terminal apophysis (2 h in Fig. 217).

Distribution. Mato Grosso to Rio de Janeiro, Brazil (Map 2D).

Specimens Examined. BRAZIL *Rio de Janeiro:* Rio de Janeiro, Duque de Caxias, 5 Sep. 1961, 1♂ (M. Alvarenga, AMNH); Silva Jardim, Aug. 1975, 1♂ (M. Alvarenga, AMNH); Santa Maria Madalena, July 1960, 1♂ (M. Alvarenga, AMNH).

Mangora puerto new species
Figures 218–220; Map 1F

Holotype. Female holotype and one female paratype from 30 km SW Puerto Maldonado, 290 m, Zona Reservada Tambopata, 12°50′S, 69°17′W, Madre de Dios, Peru, 6–14 Sep. 1984 (T. L. Erwin), in USNM. The specific name is a noun in apposition after the type locality. Puerto is Spanish word for port.

Description. Female holotype [poorly preserved]. Carapace yellow, eye region dark gray. Sternum, legs dark grayish yellow. Abdomen: whitish, dorsum with median dorsal gray band and on each side two large patches containing white pigment spots (Fig. 220); venter without marks. Eyes small. Posterior eye row slightly procurved. Ocular quadrangle square. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 1.0 diameter apart, 1.2 from laterals. Posterior median eyes 1.0 diameter apart, 1.5 from laterals. Height of clypeus equals 1.3 diameters of anterior median eyes. Total length 3.0 mm. Carapace 1.2 mm long, 1.0 wide in thoracic region, 0.4 wide behind lateral eyes, 1.1 high. First femur 1.3 mm, patella and tibia 1.3, metatarsus 0.8, tarsus 0.4. Second patella and tibia 1.2 mm, third 0.8, fourth 1.2.

The male is not known.

Diagnosis. Mangora puerto epigynum, unlike others, in ventral view has a dark wedge-shaped sclerite forming a small lobe on each side along the rim (Fig. 218), and in posterior view, a wide median plate and narrow lateral plates (Fig. 219).

Natural History. Specimen collected by canopy fogging.

Distribution. Upper Amazon: southern Peru (Map 1F).

Specimens Examined. No other specimens have been found.

Mangora botelho new species
Figures 221, 222; Map 3A

Holotype. Male holotype from Parque Estadual de Carlos Botelho, São Miguel Arcanjo, São Paulo, Brazil, 14 Oct. 1990 (A. B. Bonaldo), in MCN

20476. The specific name is a noun in apposition after the type locality.

Description. Male holotype. Prosoma yellowish. Abdomen: white, dorsum with some posterior gray, spinnerets gray (Fig. 221). Posterior eye row recurved. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 1.0 diameter apart, 0.5 from laterals. Posterior median eyes 1.0 diameter apart, 1.3 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 2.2 mm. Carapace 1.1 mm long, 1.0 wide in thoracic region, 0.4 wide behind lateral eyes, 0.6 high. First femur 1.0 mm, patella and tibia 1.3, metatarsus 1.0, tarsus 0.7. Second patella and tibia 1.2 mm, third 0.7, fourth 1.0.

The female is not known.

Diagnosis. Mangora botelho palpus differs from that of *M. uziga* (Fig. 230) by having a wider embolus, partly hidden by the cymbium, and a differently shaped terminal apophysis (Fig. 222).

Distribution. Southern Brazil, from São Paulo to Rio Grande do Sul (Map 3A).

Specimens Examined. BRAZIL *Rio Grande do Sul:* Morro do Tigre, 29°50′S, 50°52′W, 15 July 2000, 1♂ (A. B. Bonaldo, MCN 33091).

Mangora uziga new species
Figures 223–230; Map 3A

Holotype. Male holotype from Parque Nacional Iguazú, Misiones, Argentina, 22–30 Aug. 1986 (M. Ramírez), in MACN. The specific name is a noun in apposition, an arbitrary combination of letters.

Description. Female paratype from Apa. Prosoma orange, except for black labium, endites, sternum. Abdomen: dorsum gray (Fig. 225); venter gray with paired light patches (Fig. 226); sides with three light patches (Figs. 225, 226). Posterior eye row recurved. Ocular quadrangle about square. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.6 diameter apart, 0.6 from laterals. Posterior median eyes 0.6 diameter apart, 1.1 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 3.2 mm. Carapace 1.3 mm long, 1.1 wide in thoracic region, 0.4 wide behind lateral eyes, 1.1 high. First femur 1.2 mm, patella and tibia 1.5, metatarsus 1.1, tarsus 0.5. Second patella and tibia 1.2 mm, third 0.8, fourth 1.2.

Male from Paraguay. Prosoma orange, except for black labium, endites, and sternum. Abdomen: dorsum black (Fig. 227); venter black with paired white patches (Fig. 228); sides white. Posterior eye row recurved. Ocular quadrangle about square. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 1.1 diameters apart, 0.9 from laterals. Posterior median eyes 1.0 diameter apart, 1.1 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Height of carapace equals length of structure (Fig. 229). Total length 2.6 mm. Carapace 1.1 mm long, 0.9 wide in thoracic region, 0.3 wide behind lateral eyes, 1.1 high. First femur 1.2 mm, patella and tibia 1.2, metatarsus 0.8, tarsus 0.6. Second patella and tibia 1.1 mm, third 0.7, fourth 1.1.

Males and females were matched because of similar coloration.

Diagnosis. The ventral view of the *M. uziga* epigynum differs from all others by being angular on both sides and having only a short, wide median tongue (Fig. 223). The posterior view has a wider than long, oval median plate (Fig. 224).

The male palpus differs by having a narrower embolus (Fig. 230) than that of *M. botelho* (Fig. 222) and a differently shaped terminal apophysis (2 h in Fig. 230).

Distribution. Paraguay and northeastern Argentina (Map 3A).

Specimens Examined. PARAGUAY *Concepción:* Apa, Jan.–Feb. 1909, 2♀, 1♂ (AMNH Ac. 3721). *Alto Paraná:* Taquarazapa, ?1908–1909, 1♀ (AMNH Ac. 3721).

Mangora caballero new species
Figures 231–237; Map 3B

Holotype. Female holotype from Parque Provincial Cruce Caballero, Misiones, Argentina, 27–29 Oct.

1994 (M. J. Ramírez), in MACN. The specific name is a noun in apposition after the type locality. Caballero is Spanish for gentleman or knight.

Description. Female holotype. Female light orange-yellow. Abdomen: dorsum with white pigment spots and a dark median band (Fig. 235); venter with pair of gray patches anterior to spinnerets; sides with posterior gray patch. Posterior eye row procurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 1.1 diameters of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 1.0 diameter apart, 1.0 from laterals. Posterior median eyes 0.3 diameter apart, 1.3 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 2.9 mm. Carapace 1.2 mm long, 1.0 wide in thoracic region, 0.4 wide behind lateral eyes, 0.6 high. First femur 1.2 mm, patella and tibia 1.4, metatarsus 1.1, tarsus 0.5. Second patella and tibia 1.2 mm, third 0.8, fourth 1.2.

Male paratype. Prosoma yellow. Abdomen: dorsum white, shading into gray posteriorly; venter, book lung covers gray; sides light gray. Posterior eye row slightly procurved. Ocular quadrangle wider than anterior width, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.6 diameter apart, 0.2 from laterals. Posterior median eyes 0.3 diameter apart, 1.0 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Total length 2.2 mm. Carapace 1.1 mm long, 0.9 wide in thoracic region, 0.4 wide behind lateral eyes, 0.7 high. First femur 1.2 mm, patella and tibia 1.3, metatarsus 1.0, tarsus 0.5. Second patella and tibia 1.2 mm, third 0.7, fourth 1.2.

Males and females were collected at the same locality.

Variation. Total length of females 2.7 to 3.1 mm, males 1.8 to 2.3. A female from San Antonio has a colorless abdomen (Fig. 236).

Diagnosis. The epigynum of *M. caballero* differs from all others by having a median depression with a posterior, transverse, thick lip (Figs. 231, 233) and a quadrangleal posterior median plate (Figs. 232, 234).

The male palpus differs from that of *M. botelho* (Fig. 222) and *M. uziga* (Fig. 230) by a having a short, straight embolus (Fig. 237) and a large median apophysis of which the distal end is folded (4 h in Fig. 237)

Distribution. Southern Brazil to northeastern Argentina (Map 3B).

Paratype. ARGENTINA *Misiones:* Parque Provincial Cruce Caballero, 27–29 Oct. 1995, 1♂ (M. J. Ramirez, MACN).

Specimens Examined. BRAZIL *Minas Gerais:* Lavras, 5 Dec. 1978, 1♂; 29 Mar. 1979, 1♀ (W. D. Fronk, MCZ). *Rio Grande do Sul:* Tenente Portela, Parque Estadual do Turvo, 15 Jan. 1985, 1♂ (A. A. Lise, MCN 12974). ARGENTINA *Misiones:* San Antonio, Dec. 1956, 1♀ (M. J. Viana, MACN).

Mangora cercado new species
Figures 238–240; Map 3A

Holotype. Female holotype from Porto Cercado [near Poconé], Mato Grosso, Brazil, 2 Aug. 1992 (A. A. Lise, A. Braul), in MCP 2460. The specific name is a noun in apposition after the type locality. Portuguese "cercado" means "surrounded".

Description. Female holotype. Prosoma yellowish, except eyes with black rings. Abdomen: dorsum except midline with white spots, posterior with three pairs of indistinct gray spots (Fig. 240); venter with a band of white spots on each side. Pos-

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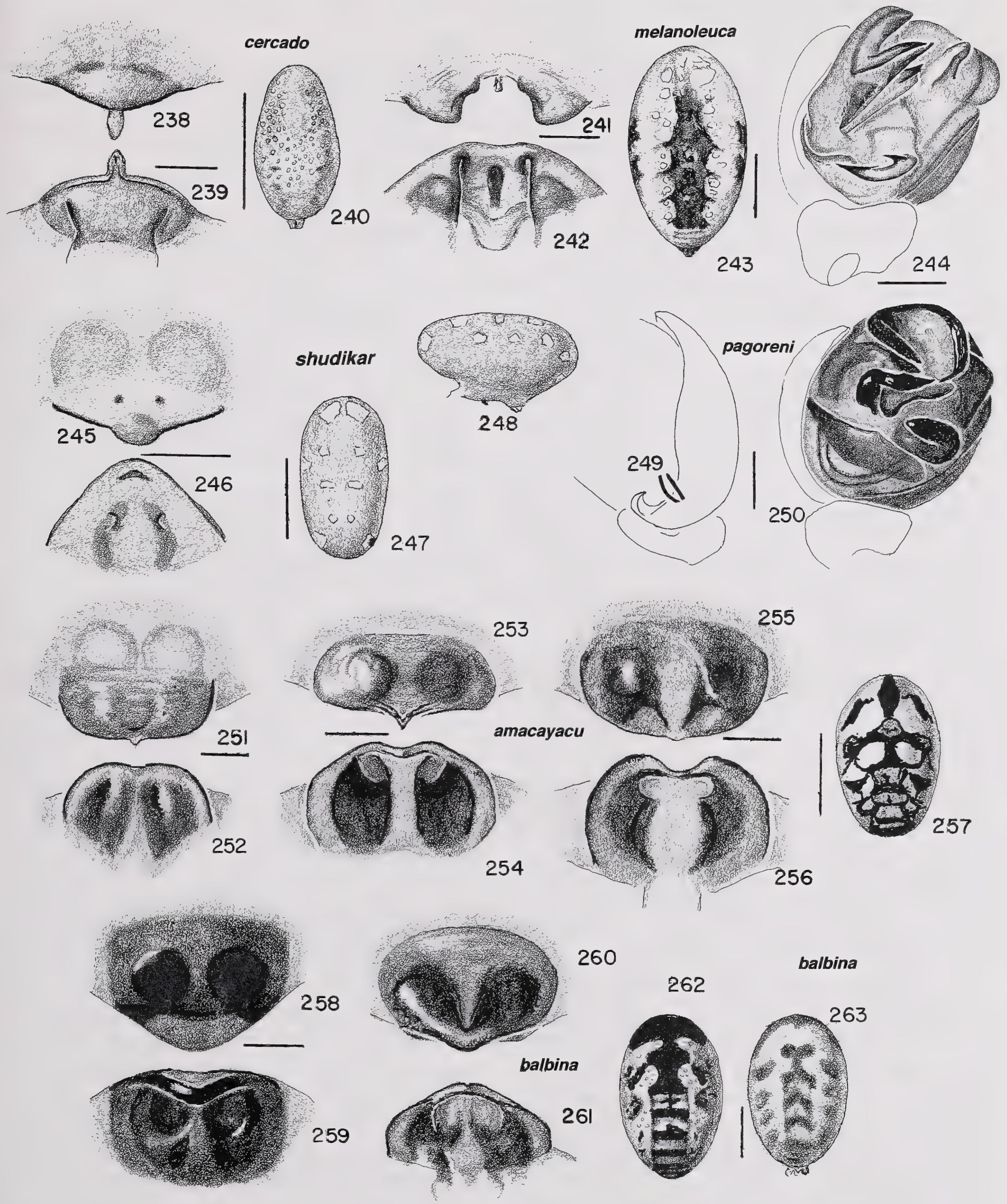
Figures 238–240. *Mangora cercado* new species, female. 238, 239, epigynum. 238, ventral; 239, posterior. 240, abdomen, dorsal.

Figures 241–244. *M. melanoleuca* (Mello-Leitão). 241–243, female. 241, 242, epigynum. 231, ventral; 242, posterior. 243, abdomen, dorsal. 244, left male palpus, mesal.

Figures 245–248. *M. shudikar* new species, female. 245, 246, epigynum. 245, ventral; 246, posterior. 247, abdomen, dorsal. 248, abdomen, lateral.



Figures 249, 250. *M. pagoreni* new species, male palpus. 249, cymbium, paracymbium, ectal. 250, mesal.

Figures 251–257. *M. amacayacu* new species, female. 251–256, epigynum. 251, 253, 255, ventral; 252, 254, 256, posterior. 257, abdomen, dorsal.

Figures 258–263. *M. balbina* new species, female. 258–261, epigynum. 258, 260, ventral; 259, 261, posterior. 262, 263, abdomen, dorsal.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

terior eye row strongly procurved. Ocular quadrangle slightly longer than wide; anterior widest. Posterior median eyes 0.9 diameter of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 1.0 diameter apart, 1.0 from laterals. Posterior median eyes 1.0 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. The legs are noticeably thin. Total length 2.3 mm. Carapace 1.0 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.4 high. First femur 1.2 mm, patella and tibia 1.2, metatarsus 0.9, tarsus 0.5. Second patella and tibia 1.1 mm, third 0.7, fourth 1.1.

The male is not known.

Diagnosis. The oval transverse swelling of the epigynum with the narrow, short diamond-shaped scape (Fig. 238) and the shape of the median plate in posterior view (Fig. 239) separate *M. cercado* from all other species.

Distribution. Southern Mato Grosso, Brazil (Map 3A).

Specimens Examined. No other specimens have been collected.

Mangora melanoleuca Mello-Leitão
Figures 241–244; Map 3A

Mangora melanoleuca Mello-Leitão, 1941: 150, figs. 45, 46, ♀♂. Female holotype from Coronel Moldes, male paratype from Pampa Blanca, Jujuy, Argentina, in MLP ♀ no. 14795, ♂ no. 14796, examined. Platnick, 2006.

Note. It is not possible to interpret Mello-Leitão's illustration of the epigynum.

Note. Both sexes examined came from Jujuy. They probably belong together. Unfortunately, at the time I examined the specimens (1974), I did not describe them and the description here comes from Mello-Leitão (1941).

Description. Female holotype. Prosoma yellow, sternum black. Abdomen: dorsum with dark median band (Fig. 243). Posterior eye row recurved. The anterior medians separated by their diameter and by their diameter from laterals. The posterior medians are separated by their diameter and by less from laterals. Total length 2.4 mm.

Male. Total length 3.6 mm. The male lacks the macroseta on the venter of the fourth femur (C. Ituarte and L. Pereira, personal communication).

Diagnosis. The female of *M. melanoleuca* differs from that of *M. yakupoi* (Figs. 191–195) by its coloration (Fig. 243), and by the narrower, more convex median notch of the epigynum (Figs. 241, 242).

The palpus is weakly sclerotized and is distinguished by the median apophysis with two spines, both pointing toward the cymbium (6 h in Fig. 244).

Distribution. Only known from northwestern Argentina (Map 3A).

Specimens Examined. No other specimens were found.

Mangora shudikar new species
Figures 245–248; Map 3C

Holotype. Female holotype from Upper Shudikar River, above camp, British Guiana [Guyana], 7, 8 Jan. 1938 (W. G. Hassler), in AMNH. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma light orange; legs lighter than carapace. Abdomen: orange-white, dorsum with pairs of large white pigment patches (Figs. 247, 248); venter orange-white. Posterior eye row straight. Ocular quadrangle as long as anterior width; anterior widest. Posterior median eyes 0.7 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.3 diameter apart, 0.3 from laterals. Posterior median eyes 0.6 diameter apart, 1.2 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Abdomen: narrow (Fig. 247), overhanging spinnerets (Fig. 248). Total length 3.4 mm. Carapace 1.5 mm long, 1.2 wide in thoracic region, 0.6 wide behind lateral eyes, 0.8 high. First femur 1.3 mm, patella and tibia 1.4, metatarsus 0.6, tarsus 0.4. Second patella and tibia 1.3 mm, third 0.7, fourth 1.2.

The male is not known.

Diagnosis. Mangora shudikar epigynum is lightly sclerotized and distinguished by

being triangular, with a median swollen lobe and a pair of dark dots in the center (Fig. 245); in posterior view, the plates appear fused, with a pair of small openings within narrow dark bands (Fig. 246).

Distribution. Only known from southern Guyana (Map 3C).

Specimens Examined. No other specimens were found.

Mangora pagoreni new species
Figures 249, 250; Map 3D

Holotype. Male holotype from Pagoreni, 465 m, 11°42′S, 72°54′W, Cuzco, Peru, Apr.–May 1998, in MUSM. The specific name is a noun in apposition after the type locality.

Description. Male holotype. Prosoma orange-yellow. Abdomen [lost]. Posterior eye row slightly recurved. Ocular quadrangle wider than long; anterior widest. Posterior median eyes 0.7 diameter of anterior medians; lateral eyes 0.4 diameter. Anterior median eyes 0.4 diameter apart, 0.3 from laterals. Posterior median eyes 0.7 diameter apart, 1.0 from laterals. Height of clypeus equals 1.2 diameters of anterior median eyes. Cymbium with a pair of macrosetae above paracymbium (Fig. 249). Fourth trochanter with a pair of small macrosetae. Fourth femur with ventral, proximal macroseta. Total length ca. 2.3 mm. Carapace 1.3 mm long, 1.2 wide in thoracic region, 0.5 wide behind lateral eyes, 0.8 high. First femur 1.4 mm, patella and tibia 1.7, metatarsus 1.2, tarsus 0.7. Second patella and tibia 1.4 mm, third 1.1, fourth 1.6.

The female is not known.

Diagnosis. Mangora pagoreni differs from all other *Mangora* males known by having two prominent macrosetae above the paracymbium of the palpus (Fig. 249).

Distribution. Upper Amazon: Cuzco, Peru (Map 3D).

Specimens Examined. No other specimens were found.

Mangora amacayacu new species
Figures 251–257; Map 3C

Holotype. Female holotype and one female paratype from Amacayacu, Parque Nacional, ca. 48 km NW Leticia, 90–100 m, Amazonas, Colombia, 03°48′S, 70°16′W, 4 Oct. 1985 (H. Sturm), in MCZ; paratype in ICNB. The species name is a noun in apposition after the type locality.

Description. Female holotype [in poor condition]. Prosoma orange, except large black rings around posterior median eyes, with legs dark orange. Abdomen: dorsum gray with black marks and white pigment spots (Fig. 257); venter orange-white with indistinct paired marks. Posterior eye row procurved. Ocular quadrangle longer than wide; posterior widest. Posterior median eyes 1.2 diameters of anterior medians; anterior lateral eyes 0.6 diameter, posterior 0.3. Anterior median eyes 0.3 their diameter apart, 0.2 from laterals. Posterior median eyes 0.4 diameter apart, 0.3 from laterals. Height of clypeus equals 0.5 diameter of anterior median eyes. Total length 3.5 mm. Carapace 1.6 mm long, 1.3 wide in thoracic region, 0.7 wide behind lateral eyes, 0.7 high. First femur 1.8 mm, patella and tibia 2.1, metatarsus 1.6, tarsus 0.7. Second patella and tibia 2.0 mm, third 1.5, fourth 1.9.

The male is unknown.

Variation. Total length of females 3.0 to 4.0 mm. The epigynum is quite variable in shape (Figs. 251, 253, 255), and specimens were first considered to belong to several species. A Venezuelan specimen has an abdomen without dorsal black pigment but instead has two narrow, longitudinal lines of white pigment spots. A female from western Brazil lacks the pointed scape (Fig. 255).

Diagnosis. Mangora amacayacu epigynum has a straight posterior edge with a minute, triangular tongue (Figs. 251, 253); in posterior view, a pair of dark areas with indistinct ventral openings are separated by a narrow lighter band (Figs. 252, 254, 256). It differs from the epigynum of *M. balbina* (Figs. 258–261) by the presence of the small triangular tongue and lacking a

lip along the margin of the epigynum. Both have relatively large, black-ringed posterior median eyes.

Natural History. Specimens from Vaupés, Colombia, were collected in tierra firma forest.

Distribution. Southern Venezuela, lower Amazon region to upper Amazon in Peru (Map 3C).

Specimens Examined. VENEZUELA *Amazonas:* Cerro de la Neblina, base camp, 140 m, 0°50′N, 66°10′W, 6 Feb. 1985, 1♀ (W. E. Steiner, USNM). COLOMBIA *Vaupés:* Mpo. Taraira, Serrania Taraira, Caño, Pintadillo, 01°01′S, 69°39′W, Mar. 2002, 3♀ (J. Pinzón, ICNB AR-3334); Río Apaporis, Lago Taraira, Estacíon Biologica Caparú, 200 m, 01°04′S, 69°31′W, Sep. 2002, 3♀ (L. Benavides, ICNB AR 3328, 3331). PERU *Loreto:* Centro de Investigacion Jenaro Herrera, 125 m, 04°55′S, 73°45′W, 23, 24 Aug. 1988, 3♀ (D. Silva D., MUSM). *Amazonas:* Cordillera del Cóndor, alto Río Comaina, Puesto de Vigilancia 22, 850–1,150 m, 29 Oct. 1987, 11♀ (D. Silva D., MUSM). *Huánuco:* Estacion Dantas, La Molina, SW de Puerto Inca, 270 m, 09°38′S, 75°00′W, 26 May 1987, 1♀ (D. Silva D., MUSM). BRAZIL *Pará:* Melgaço, Flona de Caxiuanã, 11 Aug. 1996, 1♀ (A. A. Lise, MCP 9380). *Acre:* Parque Nacional da Serra do Divisor, 14 March 1979, 1♀ (L. Resende, R. Vieira, 12611); 24 Mar. 1997, 1♀ (J. Resende, R. S. Vieira, IBSP 12274).

Mangora balbina new species
Figures 258–263; Map 3C

Holotype. Female holotype from Usina Hidroelétrica de Balbina, Presidente Figueiredo, Amazonas, Brazil, 1987, 1988 (IBSP staff), in IBSP 10816. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma orange, eye region black. Abdomen: dorsum contrastingly marked (Figs. 262, 263); venter without marks; sides gray. Posterior eye row strongly procurved. Ocular quadrangle longer than wide; posterior widest. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.4 diameter. Anterior median eyes 0.6 diameter apart, 0.4 from laterals. Posterior median eyes 0.8 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 4.0 mm. Carapace 2.0 mm long, 1.6 wide in thoracic region, 0.8 wide behind lateral eyes, 0.8 high. First femur 2.2 mm, patella and tibia 2.4, metatarsus 1.8, tarsus 0.8. Second patella and tibia 2.2 mm, third 1.3, fourth 2.2.

The male is unknown.

Variation. Total length of females 3.5 to 4.6 mm. The specimen from Jaú Moura has the posterior tip of the epigynum broken.

Diagnosis. The epigynum of *M. balbina* is heavily sclerotized and in ventral view differs from others by the very dark spermathecae at the base of the wide lobe, separated from each other by a quarter of their diameter and by the same distance from the rim (Figs. 258, 260). There is a line visible where the tip might break off. In posterior view, as in *M. amacayacu*, two depressions close to the lip are separated by a ridge.

Natural History. Specimens were collected in interior of forest.

Distribution. Amazon region (Map 3C).

Specimens Examined. BRAZIL *Amazonas:* Parque Nacional do Jaú Moura, 17 Mar. 1999, 1♀ (S. H. Borges, IBSP 28504); Manaus, Reserva do km 41, Fazenda do Esteio, 13 Jan. 1994, 1♀ (A. D. Brescovit, MCN 25358); ca. 80 km N Manaus, Cabo Frio Reserve, 13 May 1992, 1♀; 12 June 1991, 1♀ (H. G. Fowler, INPA, MCZ); 80 km N Manaus, 02°24′S, 59°52′W, 17 Jan. 1989, 1♀ (H. G. Fowler, MCZ); 80 km N Manaus, Colosso Reserve, 23 Nov. 1989, 1♀, 5 Apr. 1990, 1♀; 5 June 1991, 1♀ (H. G. Fowler et al., HGF, MCZ); 80 km N of Manaus, Dimona Reserve, 1989–1992, 1♀; 26 March 1961, 1♀; 26 June 1991, 1♀ (H. G. Fowler et al., MCZ).

Mangora aripeba new species
Figures 264–268; Map 3B

Holotype. Female holotype from Ponta da Aripeba, Ilha Grande, Angra dos Reis, Rio de Janeiro, Brazil, 13–16 Nov. 1993 (A. B. Bonaldo), in MCN 24840. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma orange. Abdomen: dorsum whitish, with two indistinct bands of white anterior pigment spots, and a pair of posterior black lines (Fig. 266); venter without marks. Posterior eye row procurved. Ocular quadrangle longer than wide, rectangular. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.8 diameter. An-

terior median eyes 1.0 diameter apart, 0.7 from laterals. Posterior median eyes 0.6 diameter apart, 1.0 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Total length 3.8 mm. Carapace 1.7 mm long, 1.3 wide in thoracic region, 0.7 wide behind lateral eyes, 1.0 high. First femur 1.8 mm, patella and tibia 2.2, metatarsus 1.8, tarsus 0.9. Second patella and tibia 2.0 mm, third 1.3, fourth 2.0.

Male from Vicosa. Coloration as in female. Posterior eye row procurved. Ocular quadrangle longer than wide; anterior widest. Posterior median eyes 1.3 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 1.1 diameters apart, 0.5 from laterals. Posterior median eyes 0.5 diameter apart, 1.0 from laterals. Height of clypeus equals 1.2 diameters of anterior median eyes. Total length 2.2 mm. Carapace 1.2 mm long, 0.9 wide in thoracic region, 0.3 wide behind lateral eyes, 0.5 high. First femur 1.2 mm, patella and tibia 1.5, metatarsus 1.1, tarsus 0.6. Second patella and tibia 1.4 mm, third 0.8, fourth 1.3.

Males and females have been collected together.

Variation. Total length of females 3.3 to 4.2 mm, males 2.1 to 2.3.

Diagnosis. Mangora aripeba female is larger (Fig. 266) than that of *M. ramirezi* (Fig. 299), in posterior view of the epigynum has a median plate with parallel sides, and lacks the pair of tiny depressions near the margin of the epigynum (Fig. 265).

The male palpus of *M. aripeba* lacks the shield-shaped projection of the terminal apophysis of *M. ramirezi* (Fig. 301) and differs by having a short embolus (Fig. 267).

Distribution. Minas Gerais and Rio de Janeiro, Brazil (Map 3B).

Specimens Examined. BRAZIL *Minas Gerais:* Vicosa, 1930, 1♀, 1♂ (Hambleton, CU). *Rio de Janeiro:* Rio de Janeiro, Parque Nacional da Tijuca, Floresta dos Macacos, April 1961, 2♂ (M. Alvarenga, AMNH); Represa Rio Grande, Feb. 1976, 2♀, 3♂ (M. Alvarenga, AMNH); Jacarepaguá, Rio de Janeiro, 19 Oct. 1964, 1♀ (P. San Martín, MACN); Paineiras, Rio de Janeiro, 6 May 1961, 1♀ (M. Alvarenga, AMNH).

Mangora huallaga new species
Figures 269–273; Map 3D

Holotype. Female holotype from Monzón Valley, Tingo María [Dep. Huánuco], Peru, 19 Oct. 1954 (R. I. Schlinger, E. S. Ross), in CAS. The specific name is a noun in apposition after the adjacent Peruvian river.

Description. Female holotype. Prosoma light orange with median eye area black. Abdomen: dorsum with indistinct gray band (Fig. 271). Posterior eye row recurved. Ocular quadrangle as long as posterior width; posterior widest. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 0.5 diameter apart, 1.0 from lateral. Posterior median eyes 0.6 diameter apart, 0.9 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 2.6 mm. Carapace 1.2 mm long, 0.9 wide in thoracic region, 0.3 wide behind lateral eyes, 0.8 high. First femur 1.2 mm, patella and tibia 1.3, metatarsus 0.8, tarsus 0.5. Second patella and tibia 1.2 mm, third 0.8, fourth 1.2.

Male. Prosoma light yellowish, eye region black. Abdomen: lighter with black ring around spinnerets and book lung covers gray. Posterior eye row procurved. Ocular quadrangle slightly wider than long; anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.6 diameter apart, almost touching laterals. Posterior median eyes 0.6 diameter apart, 1.2 from laterals. Height of clypeus equals 2.0 diameters of anterior median eyes. Total length 1.7 mm. Carapace 0.9 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.4 high. First femur 0.8 mm, patella and tibia 0.9, metatarsus 0.7, tarsus 0.4. Second patella and tibia 0.8 mm, third [lost], fourth 0.8.

Note. The association of male with female is uncertain. The female is one of the smallest *Mangora* from Peru, as is the

male, and both have been collected at the same site.

Diagnosis. Mangora huallaga epigynum (Figs. 269, 270) differs from those of *M. uziga* (Figs. 223, 224) and *M. aripeba* (Figs. 264, 265) by having a shorter, wider tongue on the margin of the epigynum (Fig. 269) and from *M. aripeba* (Fig. 264) by a wide, oval, median plate in posterior view (Fig. 270).

The male palpus of *M. huallaga* differs in having a wider embolus (Fig. 273) than *M. aripeba* (Fig. 267) and a narrower one than that of *M. corocito* (Fig. 278).

Distribution. Upper Amazon: Peru to Bolivia (Map 3D).

Paratypes. PERU *Huánuco:* Monzón Valley, Tingo María, 12 Oct. 1954, 1♀ (E. I. Schlinger, E. S. Ross in CAS); Huallaga Valley, Feb.–Apr. 1954, 1♀ (F. Woytkowski, CAS).

Specimens Examined. PERU *Huánuco:* Tingo Maria, 21 Oct. 1946, 1♂ (J. C. Pallister, AMNH). BOLIVIA *Beni:* Estación Biologica Beni, on trail from forest to Zone 1 at night, 14°47′S, 66°15′W, 9 Sep. 1987, 1♂ (J. Coddington, S. Larcher, USNM).

Mangora itabapuana new species
Figures 274–276, 283–286; Map 3B

Holotype. Female holotype from Usina Hidroelétrica de Rosal, Rio Itabapuana, between São José do Calçado, Espírito Santo, and Bom Jesus do Itabapuana, Rio de Janeiro, Brazil, Nov. 1999 (I. Knysak), in IBSP no. 26435. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellowish; black eye region and gray pigment at distal ends of leg articles. Abdomen: dorsum with scattered white pigment spots and a posterior gray band (Fig. 276); venter without marks, spinnerets gray; sides with white pigment spots. Posterior eye row procurved. Ocular quadrangle longer than wide; posterior widest. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 1.0 diameter apart, 1.0 from laterals. Posterior median eyes 0.8 diameter apart, 1.0 from laterals. Height of clypeus equals 0.5 diameter of anterior median eyes. Total length 3.1 mm. Carapace 1.2 mm long, 1.1 wide in thoracic region, 0.4 wide behind lateral eyes, 0.8 high. First femur 1.3 mm, patella and tibia 1.3, metatarsus 1.0, tarsus 0.5. Second patella and tibia 1.2 mm, third 0.7, fourth, 1.2.

The male is unknown.

Variation. Total length of females 2.6 to 3.1 mm.

Diagnosis. The posterior view of the epigynum (Figs. 275, 284) is similar to that of *M. paranaiba* (Fig. 332) by having a seam dividing median from lateral plates. The seam ends at the rim of the epigynum (Figs. 275, 284). But the *M. paranaiba* epigynum has only a small median tongue, and the spermathecae are far anterior (Fig. 331), whereas in *M. itabapuana* they are close to the posterior lobe (Figs. 274, 283).

Distribution. Tocantins, Mato Grosso, Rio de Janeiro, Brazil (Map 3B).

Specimens Examined. BRAZIL *Tocantins:* Margem direita do Rio Araguaia, Sandolândia, 12°15′S, 50°07′W, 5–13 July 1997, 1♀ (L. S. Rocha, IBSP 12013). *Mato Grosso:* 260 km N Xavantina [Chavantina], 12°49′S, 51°46′W, 400 m, Feb.–Apr. 1969, 1♀ (Xavantina-Cachimbo Exped., MCZ).

Mangora corocito new species
Figures 277–279; Map 3E

Holotype. Male holotype from 10 km N Corocito, Bolívar (N of Las Trincheras, near Cauca River, S. Peck, personal communication), Venezuela, 18 June–3 Aug. 1987 (R. Caura, S. and J. Peck), in AMNH. The specific name is a noun in apposition after the type locality.

Description. Male holotype [in poor condition]. Carapace orange, sternum or-

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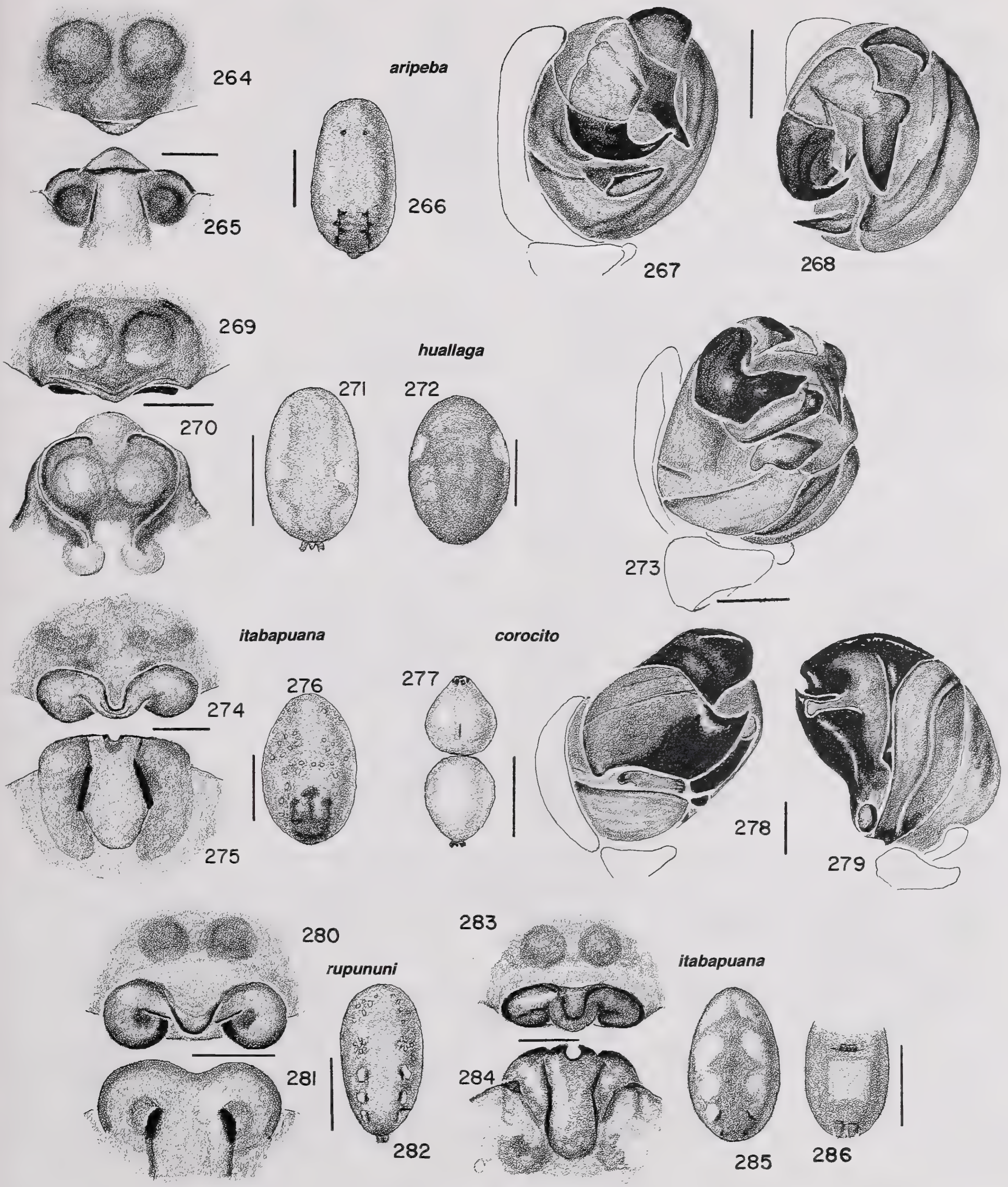
Figures 264–268. *Mangora aripeba* new species. 264–266, female. 264, 265, epigynum. 264, ventral; 265, posterior. 266, abdomen, dorsal. 267, 268, left male palpus. 267, mesal; 268, ventral.

Figures 269–273. *M. huallaga* new species. 269–272, female. 269, 270, epigynum. 269, ventral; 270, posterior. 271, 272, abdomen, dorsal. 273, male palpus, mesal.



Figures 274–276. *M. itabapuana* new species, female. 274, 275, epigynum. 274, ventral; 275, posterior. 276, abdomen, dorsal.

Figures 277–279. *M. corocito* new species, male. 277, carapace, abdomen. 278, 279, palpus. 278, mesal; 279, ventral.

Figures 280–282. *M. rupununi* new species, female. 280, 281, epigynum. 280, ventral; 281, posterior. 282, abdomen, dorsal.

Figures 283–286. *M. itabapuana* new species, female. 283, 284, epigynum. 283, ventral; 284, posterior. 285, abdomen, dorsal. 286, abdomen, ventral.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

ange with some gray. Legs light orange. Abdomen: dorsum orange-white (Fig. 277), with black ring around spinnerets; venter gray, epigastric area darker. Ocular quadrangle longer than wide; anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.7 diameter apart, 0.3 from laterals. Posterior median eyes 0.3 diameter apart, 1.2 from laterals. Anterior eyes projecting. Height of clypeus equals 1.2 diameters of anterior median eyes. Total length 2.0 mm. Carapace 1.0 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.5 high. First femur 1.0 mm [other articles lost]. Third patella and tibia 0.6 mm. Fourth femur 1.1 mm, patella and tibia 0.9 [other articles lost].

The female is unknown.

Diagnosis. Mangora corocito (Fig. 278) has a much wider, heavier embolus in the palpus than does *M. huallaga* (Fig. 273).

Natural History. The holotype came from lowland Orinoco rain forest (S. Peck, personal communication).

Distribution. Only known from central Venezuela (Map 3E).

Specimens Examined. No other specimens were found.

Mangora rupununi new species
Figures 280–282; Map 3E

Holotype. Female holotype from Rupununi River between Dadanawa and Isherton, British Guiana [Guyana], 5 Nov. 1937 (W. G. Hassler), in AMNH. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma orange. Abdomen: dorsum orange-white with areas of anterior white pigment spots, and paired posterior gray streaks, each with a white patch to the side (Fig. 282); spinnerets gray; venter orange-white. Posterior eye row procurved. Ocular quadrangle longer than wide; posterior widest. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 1.1 diameters apart, 0.8 from laterals. Posterior median eyes 0.6 diameter apart, 1.0 from laterals. Height of clypeus equals 0.7 diameter of anterior median eyes. Total length about 2.5 mm. Carapace 1.3 mm long, 0.8 wide in thoracic region, 0.5 wide behind lateral eyes, 0.6 high. Legs: [most leg articles lost]. Third patella and tibia 0.7 mm. Fourth femur 1.2 mm.

The male is not known.

Diagnosis. Mangora rupununi epigynum is similar to that of *M. itabapuana* (Figs. 274, 275), but in posterior view, the seams of the median plate stop a distance from the rim (Fig. 281), whereas in *M. itabapuana,* the seams extend to the rim (Figs. 275, 284).

Distribution. Only known from southern Guyana (Map 3E).

Specimens Examined. No other specimens have been found.

Mangora isabel new species
Figures 287–292; Map 3C

Holotype. Female holotype from 15 km south of Santa Isabel, Pará, Brazil, 29 July 2000 (A. B. Bonaldo), in MCN no. 32545a. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellowish. Carapace with eye region black and three longitudinal gray bands (Fig. 289); endites, labium, sternum dark gray; coxae yellowish; distal leg articles gray with indistinct ventral rings. Abdomen: dorsum with dark gray marks and white pigment

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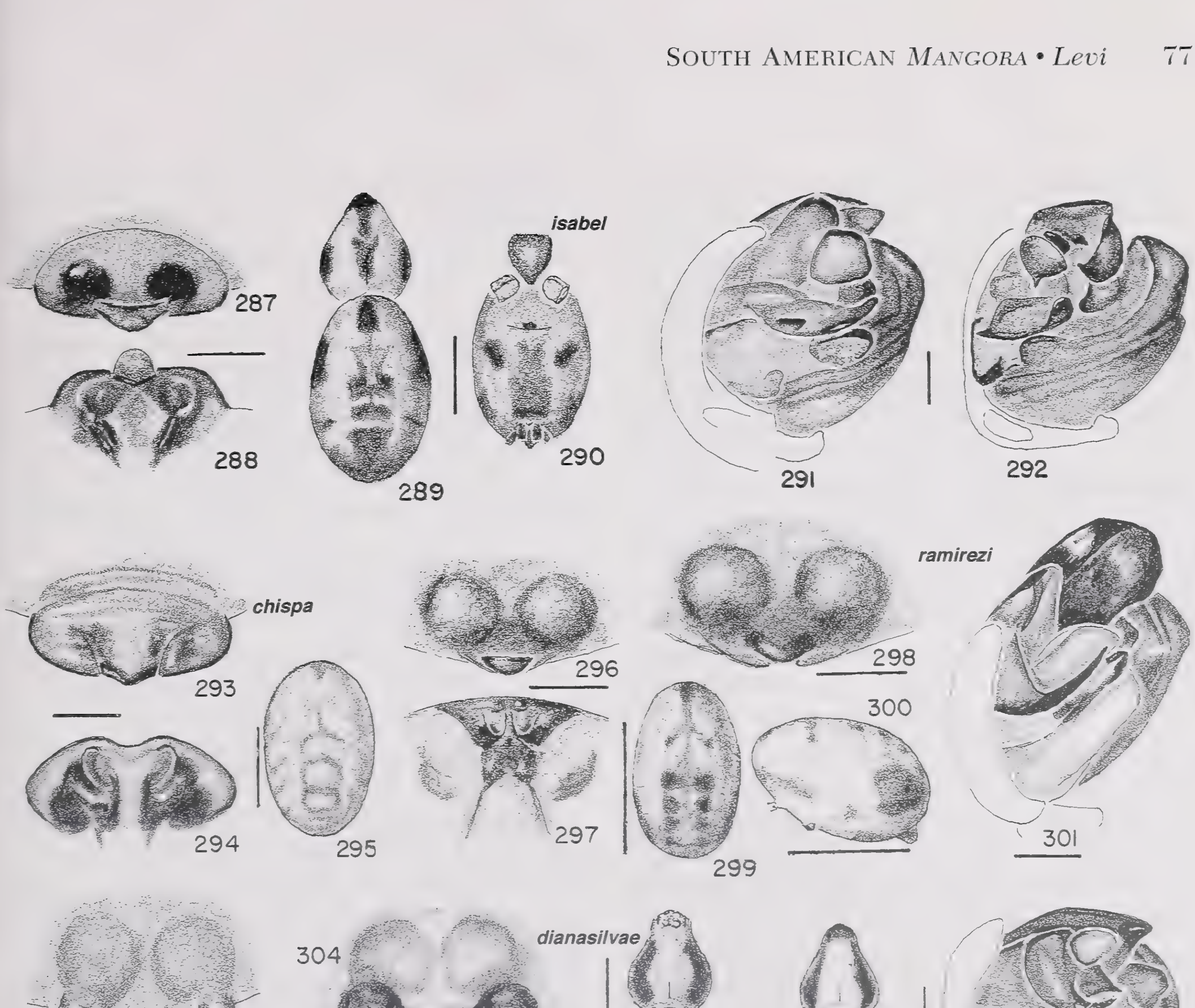
Figures 287–292. *Mangora isabel* new species. 287–290, female. 287, 288, epigynum. 287, ventral; 288, posterior. 289, carapace, abdomen. 290, sternum, abdomen. 291, 292, left male palpus. 291, mesal; 292, ventral.

Figures 293–295. *M. chispa* new species, female. 293, 294, epigynum. 293, ventral; 294, posterior. 295, abdomen, dorsal.

Figures 296–301. *M. ramirezi* new species. 296–300, female. 296–298, epigynum. 296, 298, ventral; 297, posterior. 299, 300, abdomen. 299, dorsal; 300, lateral. 301, male palpus, mesal.



Figures 302–308. *M. dianasilvae* new species, 302–307, female. 302–305, epigynum. 302, 304, ventral; 303, 305, posterior. 306, 307, carapace, abdomen. 308, male palpus, mesal.

Figures 309–312. *M. browns* new species, female. 309, 310, epigynum. 309, ventral; 310, posterior. 311, carapace, abdomen. 312, sternum, abdomen.

Figures 313–316. *M. semiatra* new species. 313–315, female. 313, 314, epigynum. 313, ventral, above, anterior ventral, below ventral; 314, posterior. 315, abdomen, above dorsal, below ventral. 316, male palpus, mesal.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

spots (Fig. 289); venter with gray marks and white pigment spots (Fig. 290). Posterior eye row straight. Ocular quadrangle wider than long: posterior widest. Posterior median eyes 1.1 diameters of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.7 diameter apart, 0.7 from laterals. Posterior median eyes 1.2 diameters apart, 1.0 from laterals. Height of clypeus equals 0.4 diameter of anterior median eyes. Total length 4.4 mm. Carapace 1.8 mm long, 1.4 wide in thoracic region, 0.6 wide behind lateral eyes, 1.0 high. First femur 1.8 mm, patella and tibia 2.1, metatarsus 1.7, tarsus 0.8. Second patella and tibia 2.0 mm, third 0.3, fourth 2.0.

Male from Belém. Coloration as in female. Posterior eye row recurved. Ocular quadrangle wider than long; anterior widest. Posterior median eyes 0.9 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.6 diameter apart, 0.2 from laterals. Posterior median eyes 0.9 diameter apart, 0.7 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 2.7 mm. Carapace 1.3 mm long, 1.1 wide in thoracic region, 0.4 wide behind lateral eyes, 0.5 high. First femur 1.4 mm, patella and tibia 1.6, metatarsus 1.1, tarsus 0.7. Second patella and tibia 1.5 mm, third 0.7, fourth 1.3.

Male and female were collected together.

Variation. Total length of females 4.3 to 4.7 mm, males 2.5 to 2.7.

Diagnosis. Mangora isabel epigynum differs from others by having the spermathecae almost their diameter apart (Fig. 287); in posterior view, it has a pair of shallow depressions near the rim and a diamond-shaped median plate (Fig. 288).

The embolus of the male palpus is hidden behind other sclerites, but a large median apophysis is visible (center of Fig. 291), resembling in shape that of *M. novempupillata* (Fig. 456). The configuration of various sclerites around the median apophysis separates the species.

Natural History. Females from Mato Grosso were found in cerrado scrub.

Distribution. Amazon region (Map 3C).

Specimens Examined. BRAZIL *Pará:* Belém, Aug. 1953, 1♂ (J. P. Duret, MACN); Canindé, Rio Gurupi, Feb.–May 1964, Feb.–May 1964, 1♀ (J. Carvalho, AMNH). *Mato Grosso:* Koluene [Rio Culuene], [Rio] Xingú, 1♀, 3♂ (J. C. Carvalho, MNRJ, det. as *Larinia bivittata* Keyserling by Mello-Leitão); 260 km N Xavantina [Chavantina], 12°49′S, 51°46′W, 400 m, Feb.–Apr. 1969, 2♀ (Xavantina-Cachimbo Exped., MCZ).

Mangora chispa new species
Figures 293–295; Map 3D

Holotype. Female holotype and one female paratype from Quebrada Chispa, NW Iscozacin, ca. 345 m, ca. 10°10′S, 75°15′W, Pasco, Peru, 1 Nov. 1986 (D. Silva D.), in MUSM. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellow, posterior median eyes with black rings. Abdomen: dorsum with an anterior gray cardiac mark, a posterior longitudinal, gray ladder, and white pigment spots (Fig. 295); sides with diagonal gray bands. Posterior eye row procurved. Ocular quadrangle slightly longer than wide, posterior slightly widest. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.5 diameter apart, 0.2 from laterals. Posterior median eyes 0.8 diameter apart, 0.6 from laterals. Height of clypeus equals 0.7 diameter of anterior median eyes. Total length 3.2 mm. Carapace 1.3 mm long, 1.2 wide in thoracic region, 0.6 wide behind lateral eyes, 0.8 high. First femur 1.5 mm, patella and tibia 1.7, metatarsus 1.3, tarsus 0.7. Second patella and tibia 1.6 mm, third 1.0, fourth 1.5.

The male is unknown.

Diagnosis. Mangora chispa differs from *M. amacayacu* (Fig. 257) by the dorsal abdominal pattern (Fig. 295). The posterior view of the epigynum differs from that of *M. amacayacu* (Fig. 254) by having larger oval openings and a differently shaped dark area (Fig. 294).

Distribution. Upper Amazon: Peru (Map 3D).

Specimens Examined. No other specimens were found.

Mangora ramirezi new species
Figures 296–301; Map 1D

Holotype. Female holotype, male paratype and one female paratype from Parque Nacional Iguazú, Area Cataratas, Misiones, Argentina, 11–16 Dec. 1999 (M. J. Ramírez, L. Lopardo), in MACN. The species is named after the collector and arachnologist M. J. Ramírez.

Description. Female holotype. Specimen yellowish with dusky line on carapace. Abdomen: dorsum with six pairs of posterior gray patches, connected by gray lines surrounded by white pigment spots (Fig. 299); sides with a posterior black patch (Fig. 300). Posterior eye row straight. Ocular quadrangle longer than wide, rectangular. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 1.0 diameter apart, 1.0 from laterals. Posterior median eyes 0.9 diameter apart, 1.5 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 2.3 mm. Carapace 1.3 mm long, 0.8 wide in thoracic region, 0.4 wide behind lateral eyes, 0.6 high. First femur 1.1 mm, patella and tibia 1.3, metatarsus 0.9, tarsus 0.5. Second patella and tibia 1.2 mm, third 0.7, femur 1.1.

Male paratype. Specimen yellowish with dusky, median line on carapace. Abdomen: dorsum with white spots and four pairs of posterior gray spots. Posterior eye row slightly procurved. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 1.0 diameter apart, 0.7 from laterals. Posterior median eyes 0.6 diameter apart, 1.2 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 1.8 mm. Carapace 1.1 mm long, 0.8 wide in thoracic region, 0.4 wide behind lateral eyes, 0.6 high. First femur 1.1 mm, patella and tibia 1.2, metatarsus 0.8, tarsus 0.5. Second patella and tibia 1.1 mm, third 0.6, femur 1.0.

Males and females were collected together.

Variation. Total length of females 2.3 to 2.7 mm.

Diagnosis. The pair of depressions on the posterior of the *Mangora ramirezi* epigynum (Fig. 297) differ from those of *M. blumenau* (Fig. 415) by being closer to the ventral rim (Fig. 297).

The male palpus differs from that of *M. dianasilvae* (Fig. 308) by the different shape of the embolus (Fig. 301) and from most species by the wide, sclerotized projecting shield of the terminal apophysis (12 h in Fig. 301).

Distribution. Southeastern Brazil and northeastern Argentina (Map 1D).

Specimens Examined. BRAZIL *Rio de Janeiro:* Paineiras, Rio de Janeiro, 22 Jan. 1959, 1♀ (A. Nadler, AMNH); Aug. 1961, 1♂ (M. Alvarenga, AMNH). *São Paulo:* Cotia, Dec. 2002, 2♀ (J. P. L. Guadanucci, H. Y. Yamaguti, MZSP); Mar. 2003, 1♀, 1♂ (M. B. Da Silva, C. A. Nogueira, MZSP); Engenheiro Marcilac, 11 Mar. 1967, 1♀, 1♂ (P. de Biasi, J. L. M. Leme, MZSP 6072). *Rio Grande do Sul:* Tenente Portela, Parque Estadual do Turvo, Salto do Yucumã, 16 Jan. 1985, 1♂ (A. A. Lise, MCN 12846). ARGENTINA *Misiones:* Santa María, Oct. 1956, 2♀ (J. M. Viana, MACN); Nov., Dec. 1956, 3♀ (J. M. Viana, MACN 3596).

Mangora dianasilvae new species
Figures 302–308; Map 3F

Holotype. Female holotype, two female, two male paratypes from Zona Reservada Tambopata, 290 m, 12°50′S, 69°17′W, Madre de Dios, Peru, 4 June–3 July, 1988 (D. Silva D.), in MCZ, one female paratype in MUSM. The species is named after the collector, arachnologist Diana Silva D.

Description. Female holotype. Prosoma light orange, with a gray band on each side of thoracic region (Figs. 306, 307). Abdomen: orange-white; dorsum with two posterior, longitudinal, parallel black bands (Fig. 306); venter without marks. Posterior eye row slightly recurved. Ocular quadrangle slightly wider than long; anterior widest. Posterior median eyes 0.9 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.5 diameter apart, 0.2 from laterals. Posterior median eyes 0.3 diameter apart, 0.9 from laterals.

Height of clypeus equals 0.7 diameter of anterior median eyes. Total length 2.8 mm. Carapace 1.2 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.8 high. First femur 1.3 mm, patella and tibia 1.4, metatarsus 1.2, tarsus 0.6. Second patella and tibia 1.3 mm, third 0.8, fourth 1.3.

Male paratype. Darker than female; lateral bands on the carapace may fuse in eye region. Sternum light gray. Abdomen: dorsal abdominal bands fuse above spinnerets; venter of abdomen light gray. Posterior eye row procurved. Ocular quadrangle slightly longer than wide, anterior widest. Posterior median eyes 0.9 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.5 their diameter apart, 0.5 from laterals. Posterior median eyes 0.2 their diameter apart, 0.7 from laterals. Height of clypeus equals 0.4 diameter of anterior median eye. Total length 1.8 mm. Carapace 1.1 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.5 high. First femur 1.1 mm, patella and tibia 1.2, metatarsus 0.9, tarsus 0.5. Second patella and tibia 0.9 mm, third 0.7, fourth 0.8.

Males and females have been collected together.

Variation. Total length of females 2.4 to 3.4 mm, males 1.8 to 2.8. The specimen from Trinidad is the largest and is light colored, except for the prosoma, which is golden-yellow. Some specimens from Peru are dark, as in *M. chacobo* (Figs. 328, 329). The illustrations in Figures 302, 303, 306, 308 were made from the holotype and paratypes, Figures 304, 305, 307 from a specimen from Trinidad.

Diagnosis. In ventral view, the epigynum of *M. dianasilvae* has a thin bar with lateral dark ends, and the spermathecae almost seem to touch (Figs. 302, 304). In posterior view, distinct curved openings are close to the ventral margin (Figs. 303, 305), whereas in *M. chacobo*, the margin appears folded, the median lobe is narrower, and the spermathecae are smaller and more anterior (Figs. 324, 326); in posterior view, the *M. chacobo* epigynum lacks the two lateral openings (Fig. 325).

The male palpus has a short, stout, curved embolus and a drawn out median apophysis, blunt and with a hook at the distal tip (4 h in Fig. 308). It lacks the transparent lobe above the embolus and elongate pocket of the median apophysis in the palpus of *M. chacobo* (Fig. 330).

Natural History. Specimens have been found in the forest interior in reserves north of Manaus and in gallery forest in Mato Grosso.

Distribution. Widespread from Trinidad, Amazon region to southern Mato Grosso, Brazil (Map 3F).

Paratypes. PERU *Madre de Dios:* Tambopata Reserve, 30 km air S Puerto Maldonado, 8–13 Jan. 1986, 1♂ (J. B. Heppner, FSCA). Zona Reservada Tambopata, 290 m, 12°50′S, 69°17′W, 6 June 1988, 1♀ (J. Coddington, USNM); July–Aug. 1979 (A. Rypstra, USNM).

Specimens Examined. TRINIDAD Cumuto [10°35′N, 61°12′W], Oct. 1926, 1♀ (W. S. Brooks, MCZ). VENEZUELA *Bolívar:* 40 km W Santa Elena, 1,000 m, 7 July 1987, 3♂ (S. and J. Peck, AMNH). COLOMBIA *Amazonas:* Leticia, km 7, Via Tarapacá, 200 m, 29 Oct. 1996, 1♀ (E. Flórez, ICNB AR-3487); Laguna Matamata, 03°41′S, 70°15′W, Nov. 2001, 3♀ (ICNB AR-3344d). PERU *Loreto:* Explorama Inn, 40 km NE Iquitos, 19, 21 July 1989, 1♀ (G. B. Edwards, FSCA); Bosque Nacional Pacaya-Samiria, Pithecia, 05°06′S, 74°50′W, ca. 100 m, 14–15 Aug. 1989, 2♀, 1♂ (D. Silva D., MUSM). *Amazonas:* Cordillera del Cóndor, alto Río Comaina, Puesto de Vigilancia 22, 850–1,150 m, 24–29 Oct. 1987, 15♀, 4♂ (D. Silva D., MUSM). *San Martín:* Mishqui-yacu, 1,600 m, 20 km NE Moyobamba, Aug. 1947, 1♀ (F. Woytowski, AMNH). *Húanuco:* Tingo María, 21 Nov. 1946, 1♀; Jan. 1947, 1♀ (J. C. Pallister, AMNH); Huallaga Valley, Feb–Apr. 1954, 14 ♀ (F. Woytkowski, CAS); Sta. Teresa, Huallaga R., 600 m, Aug. 1954, 7♀ (F. Woytkowski, CAS); Cucharas, Huallaga Valley, Feb.–Apr. 1954, 1♂ (F. Woytkowski, CAS). *Pasco:* Quebrada Chispa, NW Iscozacin, ca. 345 m, 10°10′S, 75°15′W, 3 Nov. 1986, 2♀, 2♂ (D. Silva D., MUSM). *Cuzco:* Ruinas Machu Picchu, 2,000–2,400 m, 4 Jan. 1982 (Harrington, Weintraub, MCZ). *Madre de Dios:* Tambopata Reserve, 30 air km S Pto. Maldonado, 8–13 Jan. 1986, 1♂ (J. B. Heppner, FSCA). BRAZIL *Pará:* Jacareacanga, Oct. 1959, 1♂ (M. Alvarenga, AMNH). *Amazonas:* Fonte Boa, Nov. 1975, 1♂ (M. Oliveira, AMNH); Manaus, Reserva Florestal Adolpho Ducke, 3–5 Aug. 1987, 4♀ (A. A. Lise, MCN 27433, 27436, 27437); 19 Dec. 1987, 1♀ (A. A. Lise, MCN 27434); km 62, Manaus,

Caracarai, 13 July 1977, 1♂ (J. Grazia, MCN 9475); Porto Alegre, 1989–1992, 1♀ (H. G. Fowler, INPA); 80 km N Manaus, Colosso Reserve, 9 Apr. 1989, 1♀ (H. G. Fowler, MCZ); 23 June 1990, 1♀ (H. G. Fowler et al., HGF); 80 km N Manaus, Reserva Dimona, 27 Mar. 1991, 1♀; 15 May 1991, 1♀, 1♂; 26 June 1991, 1♀ ; 25, 26 July 1991, 1♀, imm. (H. G. Fowler et al., HGF, IBSP, MCZ); ca. 80 km N Manaus, Cabo Frio Reserve, 4 Apr. 1990, 1♀; 12 June 1991, 1♀ (H. G. Fowler, MCN, HGF); km 41 Reserve near Manaus, 23 May 1991, 1♀ (H. G. Fowler, MCZ). *Acre:* Xapurí, Reserva Extrativista de Pimenteira, 5–7 Apr. 1996, 1♂ (IBSP/SMNK staff, IBSP 16037). *Mato Grosso:* 260 km N Xavantina [Chavantina], 12°49′S, 51°46′W, 400 m, Feb.–Apr. 1969, 2♀, 2♂ (Xavantina-Cachimbo Exped., MCZ); Sinop, Oct. 1976, 3♂ (M. Alvarenga, AMNH); NE Cáceres, 20 July 1988, 1♀ (P. Salinas, AMNH). BOLIVIA *Beni:* 27 km SW Yucumo, ca. 15°23′S, 66°59′W, 500 m, 15–19 Nov. 1989, 1♂ (J. Coddington et al., USNM).

Mangora browns new species
Figures 309–312; Map 3E

Holotype. Female holotype from Browns Berg, Brokopondo Prov., 05°N, 55°27′W Suriname, 20 Feb. 1982 (D. Smith Trail), in MCZ. The name is a noun in apposition after the type locality.

Description. Female holotype. Carapace orange, with eye region black and black longitudinal band, a gray patch on each side of thoracic region (Fig. 311). Chelicerae orange. Endites, labium, sternum black. Legs grayish orange with indistinct gray rings on tibiae. Abdomen: dorsum orange-white, with contrasting markings and areas with white pigment spots (Fig. 311); venter with a black median band (Fig. 312); sides with black marks. Posterior eye row slightly procurved. Ocular quadrangle longer than wide, posterior widest. Posterior median eyes 1.3 diameters of anterior medians; anterior lateral eyes 0.8 diameter, posterior 0.7. Anterior median eyes their diameter apart, 1.0 from laterals. Posterior median eyes 1.2 diameters apart, 1.0 from laterals. Height of clypeus equals 0.7 diameter of anterior median eyes. Total length 3.8 mm. Carapace 1.6 mm long, 1.5 wide in thoracic region, 0.7 wide behind lateral eyes, 0.8 high. First femur 2.0 mm, patella and tibia 2.3, metatarsus 1.8, tarsus 0.8. Second patella and tibia 2.1 mm, third 1.4, fourth [lost.]

The male is unknown.

Diagnosis. The scape of the *M. browns* epigynum has broken off (Fig. 309). The species differs from others by the adjacent black patches on the venter of the epigynum (Fig. 309). The openings are difficult to see in the black bands in posterior view (Fig. 310). It differs from the *M. isabel* (Figs. 287, 288) epigynum by having a narrower scape, and from *M. isabel* and *M. chacobo* (Figs. 324, 326) by the sculpturing of the posterior view of the epigynum.

Distribution. Only known from Suriname (Map 3E).

Specimens Examined. No other specimens have been found.

Mangora semiatra new species
Figures 1, 313–316; Map 3E

Holotype. Female holotype from San Esteban, Carabobo, Venezuela, 1887–1888 (E. Simon), in MNHN no. 10197. The specific name is the name that Simon gave the specimens. But he published no description.

Mangora semiatra Simon, 1895: 786, 787, 794 (nomen nudum); Bonnet, 1957: 2711.

Description. Female holotype. Carapace yellowish. Endites, labium, sternum gray. Femora with gray areas, coxal-femoral joint dark gray. Abdomen: dorsum gray with a darker longitudinal band and black ring around spinnerets (Fig. 315); venter gray (Fig. 315), sides with anterior white patch. Posterior eye row straight. Ocular quadrangle longer than wide, rectangular. Posterior median eyes 1.1 diameters of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.6 their diameter apart, 1.0 from laterals. Posterior median eyes 0.4 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 2.7 mm. Carapace 1.2 mm long, 0.8 wide in thoracic region, 0.5 wide behind lateral eyes, 1.1 high. First femur 1.1 mm, patella and tibia 1.3, metatarsus 0.9, tarsus 0.5. Second patella and tibia 1.2 mm, third 0.8, fourth 1.2.

Male from northern Peru. Coloration as in female, abdomen dark with three white

patches on each side. Posterior eye row slightly recurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 0.9 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.6 their diameter apart, 0.8 from laterals. Posterior median eyes 0.4 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Carapace very high. No hook on first coxa. Total length 2.0 mm. Carapace 1.3 mm long, 1.0 wide in thoracic region, 0.5 wide behind lateral eyes, 1.0 high. First femur 1.1 mm, patella and tibia 1.3, metatarsus 1.0, tarsus 0.4. Second patella and tibia 1.2 mm, third 0.8, fourth 1.3.

Males and females have been collected together.

Variation. Total length of females 2.7 to 2.9 mm. The upper Fig. 313 comes from a specimen from Peru; lower 313, 314, and upper 315 are from the holotype; lower 315 and 316 come from Peruvian specimens.

Diagnosis. Mangora semiatra is distinctively colored: the dorsum of the abdomen is black with one to three white patches on each side (Fig. 315). The epigynum is distinctive, with a scape that can be seen in slightly anterior view (upper Fig. 313); in ventral view, the rim has a lobe and circular notch on each side (lower Fig. 313); in posterior view, is a swollen, wide, oval median plate (Fig. 314).

The male palpus is similar to that of *M. missa* (Fig. 163), but the median apophysis, the conductor, and the terminal apophysis differ in shape (Fig. 316).

Distribution. Coast of Venezuela, southern Colombia to upper Amazon, Peru (Map 3E).

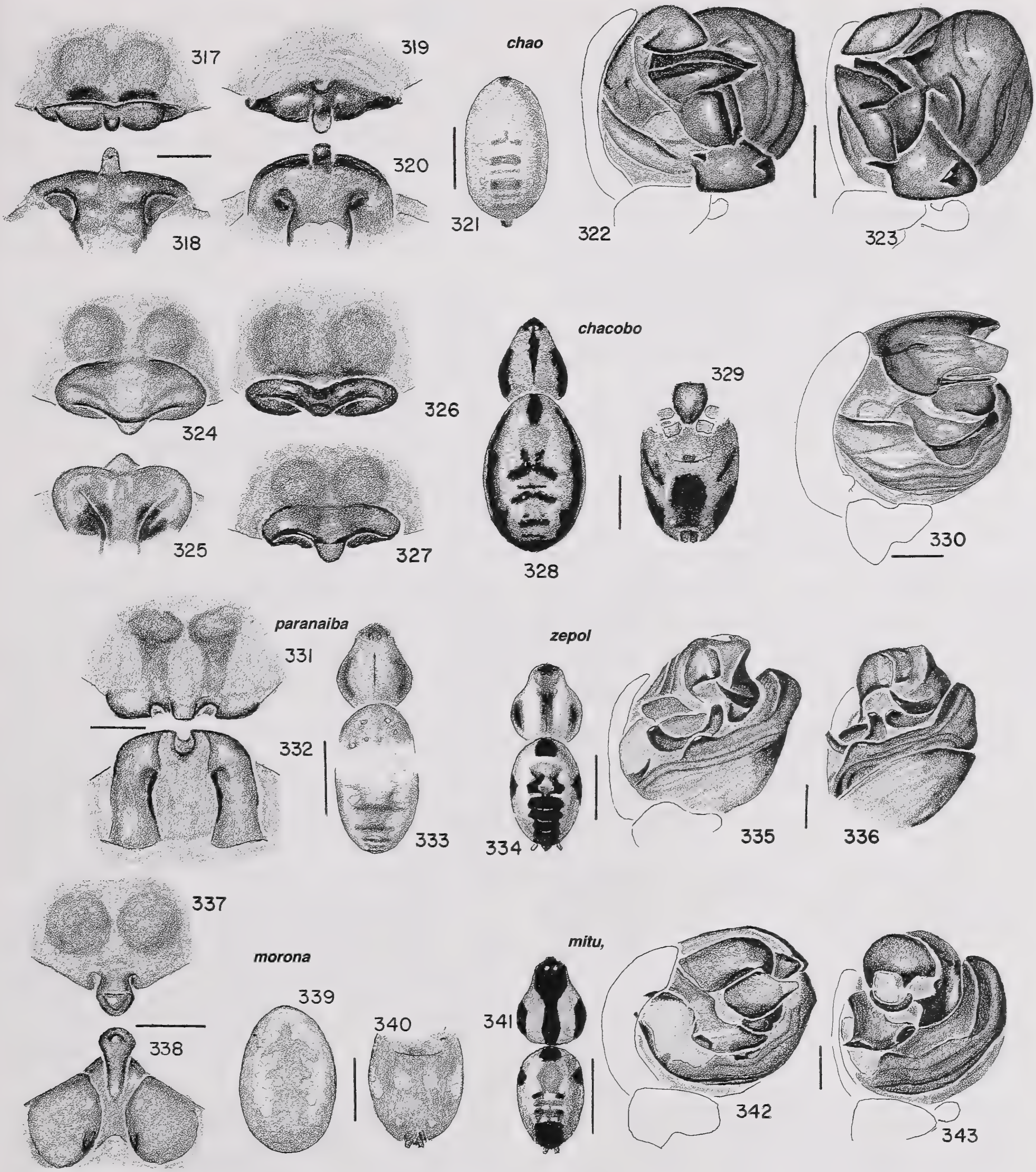
Specimens Examined. COLOMBIA *Nariño:* 29 km SE Mocoa, 2 Mar. 1955, 1♀ (E. I. Schlinger, E. S. Ross, CAS). PERU *Loreto:* Bosque Nacional Pacaya-Samiria, Pithecia, 100 m, 05°06′S, 74°50′W, 16, 17 Aug. 1989, 2♀, 2♂ (D. Silva D., MUSM); Bosque Nacional Pacaya-Samiria, Cocha Shinguito, 05°08′S, 75°45′W, 10, 22 May 1990, 17♀, 8♂ (T. Erwin et al., MUSM, MCZ). *Ucayali:* Colonia Calleria, Río Calleria, 15 km Ucuyali, 1–16 Oct. 1961, 1♀ (B. Malkin, AMNH); Pucallpa, Bosque Nacional, Alexander von Humboldt, 31 July 1986, 1♀ (D. Silva D., MUSM). *Pasco:* Huancabamba, Quebrada Chispa, NW de Iscozacin, 345 m, 10°10′S, 75°15′W, 30 Oct.–1 Nov. 1986, 5♀ (D. Silva D., MUSM); Iscozacin, Proyecto Especial Pichis-Palcazú, 26 Oct. 1986, 1♀ (D. Silva D., MUSM). *Ayacucho:* Monterico, ca. 1870, 2♀ (K. Jelski, PAN).

Mangora chao new species
Figures 317–323; Map 4D

Holotype. Female holotype from Alter do Chão, Santarém, Pará, Brazil, 26 Jan. 1994 (A. D. Brescovit), in MCN 25317. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellow; some leg articles with a ventral, distal, small black mark. Abdomen: dorsum with white pigment spots, an anterior median black mark, and well-defined posterior transverse bars (Fig. 321); venter indistinctly gray in center; sides with two bands of longitudinal white spots and a median gray patch. Posterior eye row procurved. Ocular quadrangle longer than wide, rectangular. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 0.6 diameter apart, 0.3 from laterals. Posterior median eyes 0.5 diameter apart, 1.0 from laterals. Height of clypeus equals 0.9 diameter of anterior median eyes. Total length 3.2 mm. Carapace 1.1 mm long, 1.0 wide in thoracic region, 0.3 wide behind lateral eyes, 0.7 high. First femur 1.3 mm, patella and tibia 1.4, metatarsus 0.8, tarsus 0.5. Second patella and tibia 1.2 mm, third 0.7, fourth 1.3.

Male from Paraguay. Prosoma orange. Abdomen: dorsum with white pigment spots and with three pairs of short, black, posterior transverse bars; spinnerets gray. Posterior eye row procurved. Ocular quadrangle longer than wide, rectangular. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 1.0 diameter apart, 0.3 from laterals. Posterior median eyes 1.0 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 2.0 mm. Cara-



Figures 317–323. *Mangora chao* new species. 317–321, female. 317–320, epigynum. 317, 319, ventral; 318, 320, posterior. 321, abdomen, dorsal. 322, 323, left male palpus. 322, mesal; 323, ventral.

Figures 324–330. *M. chacobo* new species. 324–329, female. 324–327, epigynum. 324, 326, 327, ventral; 325, posterior. 328, carapace, abdomen. 329, sternum, abdomen. 330, male palpus, mesal.

Figures 331–333. *M. paranaiba* new species, female. 331, 332, epigynum. 331, ventral; 332, posterior. 333, carapace, abdomen.

Figures 334–336. *M. zepol* new species, male. 334, carapace, abdomen. 335, 336, palpus. 335, mesal; 336, ventral.

Figures 337–340. *M. morona* new species, female. 337, 338, epigynum. 337, ventral; 338, posterior. 339, abdomen, dorsal. 340, abdomen, ventral.

Figures 341–343. *M. mitu* new species, male. 341, carapace, abdomen. 342, 343, palpus. 342, mesal; 343, ventral.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

pace 0.8 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.3 high. First femur 1.0 mm, patella and tibia 1.0, metatarsus 0.8, tarsus 0.5. Second patella and tibia 0.8 mm, third 0.6, fourth 1.0.

Males and females have been collected together in Paraguay.

Variation. Total length of females 2.3 to 3.2 mm. Figures 317, 318, 321 were made from the holotype; Figures 319, 320 from specimens from Mato Grosso do Sul, and Figures 322, 323 from Paraguay. Figure 319 is from slightly more anterior, 320 from slightly more ventral than Figures 317, 318.

Diagnosis. Mangora chao differs from *M. chacobo* (Figs. 324–329) by its light coloration (Fig. 321), whereas *M. chacobo* has a dark pattern on the abdomen and black thoracic region (Figs. 328, 329). Also, the epigynum of *M. chao* differs from that of *M. chacobo* by having a narrower scape (Figs. 317, 319).

The male palpus differs from all other species by the unique, long, pencil-shaped embolus and wide median apophysis with two spines (Fig. 322).

Distribution. Amazon to eastern Paraguay (Map 4D).

Specimens Examined. BRAZIL *Mato Grosso do Sul:* Corúmba, Passo do Lontra, Apr. 1998, 1♀ (J. Raizer et al., IBSP 21547). PARAGUAY *Alto Paraná:* Taquarazapa [?1908–1909], 14♀, 2♂ (AMNH Ac. 3721).

Mangora chacobo new species
Figures 324–330; Map 3G

Holotype. Female holotype, one male and one female paratypes from Estación Biológica de Beni, Beni, Bolivia (H. Höfer, A. D. Brescovit), in MCN no 24704. The specific name is a noun in apposition after the locality of a Bolivian specimen.

Description. Female holotype. Carapace yellowish, eye region black, with a median black band and black band on each side. (Fig. 328). Chelicerae, labium, endites gray. Sternum black around the margin, fading toward center (Fig. 329). Coxae yellow, distal leg articles yellow with many thin black rings. Abdomen: dorsum with white pigment spots and contrasting black marks (Fig. 328); venter contrastingly marked (Fig. 329). Posterior eye row procurved. Ocular quadrangle slightly wider than long, posterior widest. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 0.6 diameter apart, 0.6 from laterals. Posterior median eyes 1.0 diameter apart, 0.6 from laterals. Height of clypeus equals 0.6 diameter of anterior median eyes. Total length 3.7 mm. Carapace 1.7 mm long, 1.3 wide in thoracic region, 0.6 wide behind lateral eyes, 0.8 high. First femur 1.7 mm, patella and tibia 1.9, metatarsus 1.5, tarsus 0.7. Second patella and tibia 1.7 mm, third 1.1. Fourth femur 1.8 mm, patella and tibia 1.8, metatarsus 1.3, tarsus 0.7.

Male paratype. Contrastingly marked as in female. Posterior eye row procurved. Ocular quadrangle square. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 1.0 diameter apart, 0.3 from laterals. Posterior median eyes 0.8 diameter apart, 1.0 from laterals. Height of clypeus equals 0.6 diameter of anterior median eyes. Fourth femur with proximal, ventral macroseta. Total length 2.4 mm. Carapace 1.8 mm long, 1.0 wide in thoracic region, 0.4 wide behind lateral eyes, 0.5 high. First femur 1.3 mm, patella and tibia 1.5, metatarsus 1.3, tarsus 0.5. Second patella and tibia 1.3 mm, third 0.8., fourth 1.3.

Males and females have been collected together.

Variation. Total length of females 3.7 to 5.3 mm, males 2.3 to 3.0. Figures 324, 325, 328, 329 were made from the holotype; Figure 330 from a male from Bolivia; Figure 326 from Tambopata, Peru; and Figure 327 from Monzón Valley, Peru.

Diagnosis. Mangora chacobo female differs from that of *M. dianasilvae* (Figs. 302–307) by having narrow folds along the rim of the epigynum (Figs. 324, 326) and by the sculpturing in posterior view.

The male differs from that of *M. dian-*

asilvae (Fig. 308) by the transparent shield above the embolus of the palpus (2 h in Fig. 330), and the median apophysis with a slightly concave upper margin having a fold on the opposite margin (4 h in Fig. 330).

Distribution. Widespread from Amazon, upper Amazon region to southern Mato Grosso, Brazil (Map 3G).

Specimens Examined. PERU *Huánuco:* Tingo María, Cueva de las Lechuzas, 1♀, 2♂ (A. F. Archer, AMNH); Tingo María, 11 Oct. 1946, 1♀ (J. C. Pallister, AMNH); 19–25 May 1947, 1♀ (J. C. Pallister, AMNH); Monzón Valley, Tingo María, 15 Oct. 1954, 1♀ (E. S. Ross, E. I. Schlinger, CAS); Sta. Teresa, Huallaga Riv., 600 m, Aug. 1954, 1♀ (F. Woytkowski, CAS). *Pasco:* Huancabamba, Quebrada Chispa, NW de Iscozacin, 345 m, 10°10′S, 75°15′W, 3 Nov. 1986, 1♀ (D. Silva D., MUSM). *Cuzco:* Quincemil, 750 m, Sep. 1962, 1♂ (L. Peña, MCZ). *Madre de Dios:* Zona Reservada Tambopata, 290 m, 12°50′S, 69°17′W, 4 June–3 July, 1988, 1♀, 1♂ (D. Silva D., MCZ). BRAZIL *Amazonas:* Manaus, Reserva Florestal Adolpho Ducke, 7 Aug. 1992, 1♀ (H. Höfer, IBSP 10737). *Acre:* Rio Branco, Reserva Extrativista de Catuaba, 9 Apr. 1996, 1♂ (IBSP/SMNK staff, IBSP 15912); Xapurí, Reserva Extrativista de Pimenteira, 5–7 Apr. 1996, 1♂ (IBSP/SMNK staff, IBSP 16039). *Mato Grosso do Sul:* Corumbá, Morro do Azeite, Mar. 1998, 1♀ (Raizer et al., IBSP 21976). *São Paulo:* Primavera, Usina Hidrelétrica Sérgio Motta, Jan., Feb. 2000, 19♀, 5♂ (IBSP staff, IBSP, 29783, 29788). BOLIVIA *Beni:* Chacobo Indian Village, Río Benicito, 12°30′S, 66°W, 1–10 July 1960, 1♂ (B. Malkin, AMNH).

Mangora paranaiba new species
Figures 331–333; Map 4B

Holotype. Female holotype from Paranaíba, Mato Grosso do Sul, Brazil, 9 May 1983 (R. R. da Silva), in IBSP no. 14315. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellow, with black between eyes and a black band on each side (Fig. 333). Distal ends of some leg articles with dark band. Abdomen [damaged]: dorsum with large anterior white pigment spots and posterior transverse dark bands (Fig. 333); venter with gray spinnerets. Posterior eye row procurved. Ocular quadrangle longer than wide, posterior slightly widest. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 1.0 diameter apart, 1.0 from laterals. Posterior median eyes 0.8 diameter apart, 1.0 from laterals. Height of clypeus equals 0.5 diameter of anterior median eyes. Total length ca. 2.7 mm. Carapace 1.2 mm long, 0.7 wide in thoracic region, 0.4 wide behind lateral eyes, 0.7 high. First femur 1.3 mm, patella and tibia 1.4, metatarsus 1.1, tarsus 0.5. Second patella and tibia 1.3 mm, third 0.8, fourth 1.4.

The male is not known.

Diagnosis. Mangora paranaiba epigynum differs from that of all other *Mangora* by the venter, which has a very short scape flanked by notches (Fig. 331). The posterior view resembles that of *M. itabapuana* (Fig. 275), whereas that of *M. paranaiba* has a smaller tongue.

Distribution. Only known from Mato Grosso do Sul, Brazil (Map 4B).

Specimens Examined. No other specimens have been found.

Mangora zepol new species
Figures 334–336; Map 5B

Holotype. Male holotype from Hacienda Mozambique, 15 km SW Puerto Lopez, Meta, Colombia, 500 m [ca. 1970s] (W. Eberhard), in MCZ. The specific name in a noun in apposition, an anagram of the name of the type locality.

Description. Male holotype. Carapace light orange, with eye region black, thoracic region with a broad, longitudinal, gray to black band and a black band on each side (Fig. 334). Legs light orange with a gray cast. Abdomen: whitish, dorsum contrastingly marked (Fig. 334); venter with a transverse row of four indistinct patches and anterior to spinnerets gray; lung covers and spinnerets gray. Posterior eye row procurved. Ocular quadrangle longer than wide, posterior widest. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes their diameter apart, 0.6 from laterals. Posterior median eyes 0.7 their diameter apart, 0.6 from laterals. Height of clypeus equals 1.2 diameters of anterior median eyes. Total length 2.6 mm. Carapace 1.3 mm long, 1.2 wide in tho-

racic region, 0.4 wide behind lateral eyes, 0.5 high. First femur 1.4 mm, patella and tibia 1.5, metatarsus 1.2, tarsus 0.7. Second patella and tibia 1.4 mm, third 0.8, fourth 1.3.

The female is not known.

Diagnosis. The male *M. zepol* palpus has a unique boat-shaped median apophysis (center of Fig. 335, 9 h in Fig. 336) and a curved black terminal apophysis with a long spine pointing at the conductor (2 h in Figs. 335, 336); the embolus, hidden behind the conductor, is not visible.

Distribution. Only known from central Colombia (Map 5B).

Specimens Examined. No other specimens have been found.

Mangora morona new species
Figures 337–340; Map 5D

Holotype. Female holotype from Los Tayos, 03°06′S, 78°12′W [Prov. Morona-Santiago], Ecuador, 30 July 1976 (N. Engler), in MCZ. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellowish white. Abdomen: dorsum with two white pigment bands (Fig. 339); venter with two patches of white pigment spots (Fig. 340). Posterior eye row procurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.6 diameter apart, 0.4 from laterals. Posterior median eyes 0.3 diameter apart, 1.5 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 3.0 mm. Carapace 1.3 mm long, 1.0 wide in thoracic region, 0.3 wide behind lateral eyes, 0.8 high. First femur 1.3 mm, patella and tibia 1.4, metatarsus 0.9, tarsus 0.6. Second patella and tibia 1.3 mm, third 0.8. Fourth femur 1.4 mm, patella and tibia 1.4, metatarsus 1.0, tarsus 0.6.

The male is not known.

Variation. Total length of females 2.8 to 3.0 mm.

Diagnosis. The epigynum of *M. morona* differs from that of *M. paranaiba* by having a longer scape, smaller notches flanking the scape in ventral view (Fig. 337), and larger spherical spermathecae a short distance from the rim (Fig. 337).

Natural History. The holotype was collected "on a dragline at night".

Distribution. Known only from southeastern Ecuador and central Amazon region, Brazil (Map 5D).

Specimens Examined. BRAZIL *Amazonas:* Manaus, 21–23 Sep. 1997, 1♀ (R. Ott, MCP 10184).

Mangora mitu new species
Figures 341–343; Map 3H

Holotype. Male holotype from Mitú, Comissaría del Vaupés, 01°08′N, 70°03′W, Colombia, 9–15 July 1990 (L. E. Peña), in AMNH. The specific name is a noun in apposition after the type locality.

Description. Male holotype. Carapace orange with black median band and black on sides of thoracic region (Fig. 341). Chelicerae gray. Labium, endites, sternum, legs orange. Abdomen: dorsum with black and gray median marks and a black patch on each side (Fig. 341); venter with gray lung covers, a median gray rectangle, spinnerets gray. Posterior eye row straight. Ocular quadrangle slightly wider than long, almost square. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 0.8 their diameter apart, 0.7 from laterals. Posterior median eyes 0.8 their diameter apart, 0.6 from laterals. Height of clypeus equals 1.0 diameter of anterior median eye. Total length 2.8 mm. Carapace 1.5 mm long, 1.2 wide in thoracic region, 0.6 wide behind lateral eyes, 0.7 high. First femur 1.5 mm, patella and tibia 1.7, metatarsus 1.3, tarsus 0.8. Second patella and tibia 1.5 mm, third 1.0, fourth 1.6.

The female is not known.

Diagnosis. The *M. mitu* palpus differs from all others by the shape of its palpal conductor with a small light bulge (3 h in Fig. 342), by having the embolus hidden behind the conductor (3 h in Fig. 342), and by the lobe near the base of the median apophysis (Fig. 342).

Distribution. Upper Amazon: Colombia (Map 3H).

Specimens Examined. No other specimens have been found.

Mangora falconae Schenkel
Figures 3, 344–348; Map 3H

Mangora falconae Schenkel, 1953: 19, Fig. 17, ♀. Female holotype from El Pozón [07°48′N, 68°04′W], Depto. Acosta, Falcón, Venezuela in NHMB, examined. Levi, 2005: 175, figs. 193, 199, ♀♂. Platnick, 2006.

Description. The species was redescribed in Levi, 2005.

Variation. Total length of females 3.1 to 4.4 mm, males 2.6 to 2.8. The illustrations were made from the female holotype and a male from a specimen from Colombia.

Diagnosis. The *M. falconae* epigynum is lightly sclerotized and is distinguished from others by a projecting, distally swollen scape, narrow at its base (Figs. 344, 345).

Males have a distinct, heavily sclerotized median apophysis, with one point facing the cymbium in the palpus (5 h in Fig. 347, 8 h in Fig. 348) and a heavily sclerotized, elongate triangular embolus (center in Fig. 347).

Natural History. Mangora falconae was collected on plants in Colombia, in coastal thorn-scrub in Venezuela.

Distribution. Venezuela to Panama (Map 3H).

Specimens Examined. PANAMA *Chiriquí:* 1938, 1♀ (AMNH). VENEZUELA *Sucre:* Carúpano, 23–31 July 1987, 1♂ (S. and J. Peck, AMNH). COLOMBIA *Magdalena:* Tayrone Park [Tairona National Park], Gairaca, 8 km NE Santa Marta, 13 June 1985, 1♀ (H.-G. Müller, SMF); Tayrone Park, 16 km NE Santa Marta, 16 June 1985, 9♀, 1♂, 2 imm. (H.-G. Müller, SMF). *Santander:* Piedecuesta, Estacion Experimental Demostrativa El Rasgón, 2,240–2,320 m, July 2000, Feb. 2002, 5♀ (E. Blanco, ICNB AR-1951).

Mangora sciosciae new species
Figures 349–352; Map 4B

Holotype. Female holotype from Calamuchita, Córdoba, Argentina, Feb. 1953 (J. M. Viana) in MACN. The species is named after arachnologist Cristina Scioscia, curator in the Museo Argentino Ciencias Naturales.

Description. Female holotype. Prosoma orange. Carapace with a median Y-shaped gray mark (Fig. 351). Chelicerae with a gray patch. Labium, endites, sternum black. Legs with indistinct black spots. Abdomen: dorsum with a median scalloped band that disappears anteriorly (Fig. 351); venter with median gray band, bordered on sides by a narrow white band, sides of band with white pigment spots (Fig. 352). Posterior eye row recurved. Ocular quadrangle wider than long, posterior widest. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 1.0 diameter apart, 1.4 from laterals. Posterior median eyes 1.4 diameters apart, 1.3 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 4.5 mm. Carapace 1.8 mm long, 1.6 wide in thoracic region, 0.7 wide behind lateral eyes, 0.7 high. First femur 2.5 mm, patella and tibia 2.6, metatarsus 2.8, tarsus 1.0. Second patella and tibia 2.4 mm, third 1.5, fourth 2.3.

The male is not known.

Diagnosis. Mangora sciosciae epigynum differs from others by its round scape (Fig. 349) and, in posterior view, by the median plate having parallel sides (Fig. 350).

Distribution. Only known from Córdoba, north central Argentina (Map 4B).

Specimens Examined. No other specimens have been found.

Mangora taczanowskii new species
Figures 353–355; Map 5D

Holotype. Female holotype from Amable María [Dept. Junín, Prov. Tarma, 640 m, on Río Chanchamayo], Peru, ca. 1870s, in PAN. The species is named after arachnologist L. Taczanowski, for whom the specimen was collected.

Description. Female holotype. Prosoma light yellow. Abdomen: whitish, dorsum with anterior, median gray spot and indistinct posterior gray ladder-marks; sides with white pigment (Fig. 355); venter without marks or white pigment. Posterior eye row slightly procurved. Ocular quadrangle as long as posterior width, posterior widest. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.8

diameter. Anterior median eyes 0.8 diameter apart, 0.8 from laterals. Posterior median eyes 0.6 diameter apart, 1.0 from laterals. Height of clypeus equals 0.3 diameter of anterior median eyes. Total length 3.7 mm. Carapace 1.7 mm long, 1.3 wide in thoracic region, 0.7 wide behind lateral eyes, 0.9 high. First femur 1.5 mm, patella and tibia 1.8, metatarsus 1.4, tarsus 0.7. Second patella and tibia 1.6 mm, third 1.0, fourth 1.5.

The male is not known.

Diagnosis. Unlike others, the *M. taczanowskii* epigynum in ventral view has a triangular tongue (Fig. 353); in posterior view, the median plate is oval and wider than long (Fig. 354).

Distribution. Only known from central Peru (Map 5D).

Specimens Examined. No other specimens have been found.

Mangora v-signata Mello-Leitão
Figures 356–362; Map 4B

Theridion fidum Mello-Leitão, 1943: 169, figs. 13, 14, ♀. Female holotype from Rio Grande do Sul, Brazil, in MNRJ, examined. NEW SYNONYMY.

Mangora v-signata Mello-Leitão, 1943: 194, fig. 21, ♀. Female holotype from Porto Alegre [Rio Grande do Sul, Brazil], in MNRJ, lost. Platnick, 2006.

Mangora fida Levi 1967: 37, figs. 42–44, ♀. Platnick, 2006.

Note. Mello-Leitão (1943) illustrated the epigynum of *T. fidum* and the dorsal view of a light-colored female, and later the dorsal view of a dark-colored female, of *M. v-signata.* Both the dorsal band of the female abdomen and the small epigynum of *T. fidum* are diagnostic. The specimen of *T. fidum* survived, the other is lost. All specimens examined have the diagnostic ventral black spots on the first and second femur. Because it has a collecting locality, I chose the name *v-signata* for the species.

Description. Female from Porto Alegre. Carapace yellowish, with median gray line that widens in center (Figs. 358, 359). Chelicerae with a gray patch. Endites, labium partly black, sternum black (Fig. 360). Legs grayish yellow with a distal black spot and another proximally on venter of first and second femora. Venter with dusky line. Abdomen: dorsum with a median dusky band, black along its edge, and wider posteriorly, white pigment spots on sides of band (Figs. 358, 359); venter with a median gray patch (Fig. 360); sides with gray patch (Fig. 361). Posterior eye row slightly recurved. Ocular quadrangle slightly longer than wide, rectangular. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.9 diameter. Anterior median eyes 1.0 diameter apart, 1.5 from laterals. Posterior median eyes 0.6 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 3.0 mm. Carapace 1.2 mm long, 1.0 wide in thoracic region, 0.4 wide behind lateral eyes, 0.7 high. First femur 1.2 mm, patella and tibia 1.4, metatarsus 1.1, tarsus 0.6. Second patella and tibia 1.3 mm, third 0.7, fourth 1.2.

Male from Tucumán. Lighter than female, with pattern less distinct, but with black spots on each end on the venter of first and second femora and marks on sides of abdomen. Posterior eye row slightly recurved. Ocular quadrangle square. Poste-

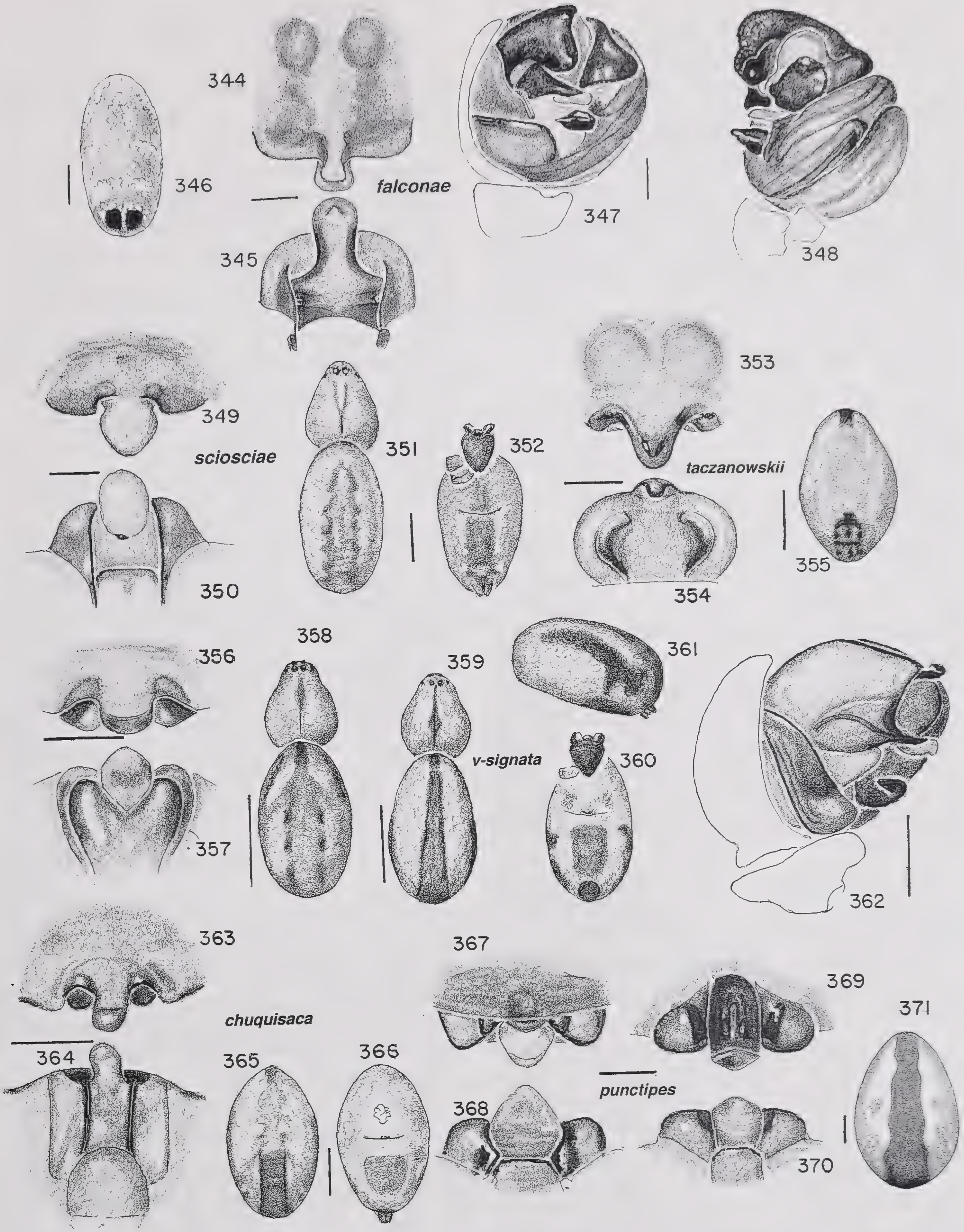
→

Figures 344–348. *Mangora falconae* Schenkel. 344–346, female. 344, 345, epigynum. 344, ventral; 345, posterior. 346, abdomen, dorsal. 347, 348, left male palpus. 347, mesal; 348, ventral.

Figures 349–352. *M. sciosciae* new species, female. 349, 350, epigynum. 349, ventral; 350, posterior. 351, carapace, abdomen. 352, sternum, abdomen.

Figures 353–355. *M. taczanowskii* new species, female. 353, 354, epigynum. 353, ventral; 354, posterior. 355, abdomen, dorsal.

Figures 356–362. *M. v-signata* Mello-Leitão. 356–361, female. 356, 357, epigynum. 356, ventral; 357, posterior. 358, 359, carapace, abdomen. 360, sternum, abdomen. 361, abdomen, lateral. 362, male palpus, mesal.



Figures 363–366. *M. chuquisaca* new species, female. 363, 364, epigynum. 363, ventral; 364, posterior. 365, abdomen, dorsal. 366, abdomen, ventral.

Figures 367–371. *M. punctipes* (Taczanowski), female. 367–370, epigynum. 367, 369, ventral; 368, 370, posterior. 371, abdomen, dorsal.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

rior median eyes 1.1 diameters of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 1.2 diameters apart, 1.0 from laterals. Posterior median eyes 1.0 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 1.9 mm. Carapace 1.0 mm long, 0.8 wide in thoracic region, 0.4 wide behind lateral eyes, 0.5 high. First femur 1.0 mm, patella and tibia 1.3, metatarsus 0.8, tarsus 0.5. Second patella and tibia 0.9 mm, third 0.7, fourth 1.0.

Male and female were collected together.

Variation. Total length of females 2.2 to 3.3 mm, Figures 356–358 were made from specimens from Rio Grande do Sul, Figures 359–362 were illustrated from a specimen from Tucumán.

Diagnosis. Mangora v-signata differs from others by having two black spots on the venter of the first and second femora. The epigynum differs from that of *M. paranaiba* (Fig. 331) and *M. sciosciae* (Fig. 349) by having larger notches flanking the parallel-sided scape of the epigynum (Fig. 356) and dark lateral areas inside the notches (Fig. 356). The posterior view of the epigynum differs from similar species by a swollen heart-shaped median plate (Fig. 357).

The male palpus differs from others by the wide embolus (Fig. 362) and the black spots on the first and second femora.

Distribution. Southern Brazil to southern Bolivia and northern Argentina (Map 4B).

Specimens Examined. BRAZIL *São Paulo:* Águas da Prata, 10 Apr. 1998, 1♀ (V. C. Onofrio, IBSP 17504). *Rio Grande do Sul:* Estrela Velha, 20 Oct. 1998, 1♀ (A, Silva, MCN 29627); Morro Santana, Porto Alegre, 1 Sep. 1980, 1♀ (A. Lise, MCN 9329); Muçum, 8 Mar. 1984, 1♀ (A. D. Brescovit, MCN 12110); Tenente Portela, Parque Estadual do Turvo, 29 Nov. 1978, 1♀ (H. Bischoff, MCN 8428); 4–6 Feb. 1980, 1♀ (A. A. Lise, MCN 8972); Três Coroas, 15 Dec. 1976, 1♀ (E. H. Buckup, MCN 4925). BOLIVIA *Chuquisaca:* E Monteagudo, 1,600 m, 21–24 Dec. 1984, 1♀ (L. E. Peña, AMNH). ARGENTINA *Tucumán:* Horco Molle, Nov. 1960, 1♀, 1♂ (M. E. Galiano, MACN 5332b).

Mangora chuquisaca new species
Figures 363–366; Map 4D

Holotype. Female holotype from east of Monteagudo, Chuquisaca, 1,600 m, Bolivia, 21–24 Dec. 1984 (L. E. Peña), in AMNH. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma orange, except eyes with black rings. Abdomen: dorsum with paired patches containing white pigment spots and a posterior, longitudinal gray band, having parallel sides, and an anterior median gray patch (Fig. 365); venter with a gray quadrangle and spinnerets black (Fig. 366); sides with gray marks, darker posteriorly. Posterior eye row straight. Ocular quadrangle as long as posterior width, posterior widest. Posterior median eyes 1.5 diameters of anterior medians; lateral eyes 0.9 diameter. Anterior median eyes 1.5 diameters apart, 1.8 from laterals. Posterior median eyes 1.0 diameter apart, 1.0 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Total length ca. 3.7 mm. Carapace 1.4 mm long, 1.2 wide in thoracic region, 0.5 wide behind lateral eyes, 0.5 high. First femur 1.6 mm, patella and tibia 1.8, metatarsus 1.4, tarsus 0.7. Second patella and tibia 1.6 mm, third 1.1, fourth 1.6.

The male is unknown.

Variation. Total length of females 3.2 to 3.7 mm.

Diagnosis. Mangora chuquisaca epigynum has a notch containing a dark structure on each side of the narrow scape (Fig. 363) and is separated from *M. v-signata* by the posterior median plate with parallel sides (Fig. 364), whereas *M. v-signata* has a heart-shaped median plate (Fig. 357).

Distribution. Southern Bolivia, northwestern Argentina (Map 4D).

Specimens Examined. ARGENTINA *Jujuy:* San Salvador de Jujuy, 20 Apr. 1989, 1♀ (L. Pereira, USNM).

Mangora punctipes (Taczanowski)
Figures 367–371; Map 5D

Epeira punctipes Taczanowski, 1878: 166, pl. 2, fig. 16, dorsal view. Two female syntypes from Mon-

terico [Depto. Ayacucho, Prov. Huanta], Peru, in PAN, examined.

Mangora punctipes:—Levi, 1991: 179; Platnick, 2006.

Description. Female syntype. Carapace brownish yellow with a gray Y-shaped mark. Large black circles around secondary eyes. Chelicerae with a gray patch. Labium, endites gray. Sternum dark brown. Coxae and distal leg articles yellow with brown spots at the bases of setae. Abdomen: dorsum with a dark longitudinal band (Fig. 371); venter with a pair of gray longitudinal bands flanked by white bands, black anterior to spinnerets. Posterior eye row recurved. Posterior median eyes 2.0 diameters of anterior medians; lateral eyes 1.3 diameters. Anterior median eyes 1.6 diameters apart, 2.0 from laterals. Posterior median eyes 1.2 diameters apart, 1.2 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Abdomen elongate oval (Fig. 371). Total length 4.5 mm. Carapace 1.6 mm long, 1.5 wide in thoracic region, 0.7 wide behind eyes, 0.7 high. First femur 1.9 mm, patella and tibia 2.3, metatarsus 1.7, tarsus [lost]. Second patella and tibia 2.1 mm, third 1.3, fourth 2.0.

The male is not known.

Variation. Total length of females 3.8 to 4.5 mm. Figures 367, 368, 371 were made from the holotype, Figures 369, 370 from Machu Picchu, Peru.

Diagnosis. Mangora punctipes, like some *M. v-signata,* does not have the typical *Mangora* pattern on the abdomen (Fig. 371) and differs also by the low carapace, eye sizes, and spotted legs, but it does have the characteristic *Mangora* trichobothria on the third patella and tibia. As in *Araneus* species, *M. punctipes* has a scape with a distal pocket (Figs. 367, 369). It differs from other *Mangora* species by having the scape of the epigynum flanked by two large brackets, each the width of the scape (Figs. 367, 369), and in posterior view by the equal width of lateral and median plates (Figs. 368, 370).

Distribution. Upper Amazon: Peru (Map 5D).

Specimens Examined. PERU *Ayacucho:* Huanta, 8 Mar. 1951, 1♀ (E. S. Ross, A. E. Michelbacher, CAS). *Cuzco:* Machu-Picchu, 1942, 1♀ (F. Putlitz, MCZ); 20 Feb. 1947, 1♀; 6, 7 Mar. 1947, 2♀ (J. C. Pallister, AMNH).

Mangora paula new species
Figures 372–376; Map 4D

Holotype. Female holotype and five male paratypes from Rincão dos Kroeff, São Francisco de Paula, Rio Grande do Sul, Brazil, 5 Jan. 1985 (A. A. Lise), in MCN 12727. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellow. Abdomen: white; dorsum with areas of white pigment spots and two pairs of short, black transverse lines; a posterior, black transverse line (Fig. 374); venter with a square of white pigment spots. Posterior eye row recurved. Ocular quadrangle wider than long, posterior widest. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 1.3 diameters apart, 2.0 from laterals. Posterior median eyes 2.0 diameters apart, 1.6 from laterals. Height of clypeus equals 0.9 diameter of anterior median eyes. Total length 4.4 mm. Carapace 2.1 mm long, 1.7 wide in thoracic region, 0.8 wide behind lateral eyes, 1.1 high. First femur 2.3 mm, patella and tibia 2.7, metatarsus 2.2, tarsus 0.8. Second patella and tibia 2.4 mm, third 1.6, fourth 2.5.

Male paratype. Coloration as in female. Posterior eye row straight. Ocular quadrangle wider than long, posterior widest. Posterior median eyes 1.8 diameters of anterior medians; anterior lateral eyes 0.8 diameter, posterior 1.0. Anterior median eyes 1.3 diameters apart, 2.0 from laterals. Posterior median eyes 1.2 diameters apart, 1.1 from laterals. Height of clypeus equals 0.5 diameter of anterior median eyes. Fourth femur with five ventral macrosetae. Total length 3.6 mm. Carapace 1.7 mm long, 1.3 wide in thoracic region, 0.6 wide behind lateral eyes, 0.7 high. First femur 2.2 mm, patella and tibia 2.5, metatarsus 1.8, tarsus 0.7. Second patella and tibia 2.1 mm, third 1.2, fourth 2.1.

Males and female were collected together.

Diagnosis. Mangora paula genitalia are weakly sclerotized. The epigynum (Figs. 372, 373) is distinguished from that of *M. v-signata* (Figs. 356, 357), *M. chuquisaca* (Figs. 363), and *M. punctipes* (Figs. 367–370) by lacking notches flanking the scape (Fig. 372). In posterior view of the epigynum, *M. paula* has narrow median plates and a pair of lateral plates, each with a central black mark (Fig. 373).

The male palpus has the median apophysis bearing two spines (4 h in Fig. 375) and a flat rounded sclerite, which may cover the embolus (center of Fig. 375).

Distribution. Only known from southern Brazil (Map 4D).

Specimens Examined. No other specimens were found.

Mangora amchickeringi Levi
Figures 377–382; Map 4A

Mangora amchickeringi Levi, 2005: 160, figs. 80–90, ♀♂. Male holotype and 16 male and 39 female paratypes from Madden Dam, Canal Zone, Panama, in MCZ. Platnick, 2006.

Mangora mobilis:—Chickering, 1954: 202, figs. 10–14, ♀♂ (misidentification).

Description. See Levi (2005). Total length of females 3.2 to 4.2 mm, males 2.3 to 2.8.

Illustrations. Illustrations of the female were made from a specimen from Trinidad, and the male from Panama.

Diagnosis. Mangora amchickeringi epigynum (Fig. 377) is like that of *M. paula* ventrally (Fig. 372); however, the posterior view differs by having a transverse, U-shaped median plate (Fig. 378).

The male palpus differs (Figs. 381, 382) from that of *M. paula* (Fig. 375) by having a sclerotized, pointed hook on the terminal apophysis (12 h in Fig. 381) above the round-topped sclerotized plate that shields the embolus (center of Fig. 381). The embolus can be seen under the plate (center of Fig. 382).

Natural History. Specimens were collected by fogging trees in middle savanna at Calabozo, Venezuela, and in dry forest and agricultural land at Atlantico, Colombia.

Distribution. Panama, Trinidad, Venezuela, northern Colombia (Map 4A).

Specimens Examined from South America. WEST INDIES. TRINIDAD St. Augustine University, April 1964, 1♀, 3♂ (A. M. Chickering, MCZ); Port of Spain, 1913, 1♀, 3♂ (R. Thaxter, MCZ); Gasparce, 3 Nov. 1944, 1♀ (R. H. Montgomery, AMNH). *St. George Co.:* Diego Martin Ward, Edith Falls, Trail, 18 Aug. 1986, 1♂ (G. B. Edwards, FSCA); San Rafael Ward, E side of Talparo River, 20 Aug. 1986, 1♂ (G. B. Edwards, FSCA). *St. Andrew Co.:* Valencia Ward, at Oropuche River, 17 Aug. 1986, 1♂ (G. B. Edwards, FSCA). VENEZUELA *Guárico:* Estacion Biologica de los Llanos, Calabozo, 280 m, 18 Jan. 1985, 1♀ (J. Palmer, MCZ); Hato Masaquarai, 45 km S of Calabozo, 17 Mar. 1980, 1♀ (K. Rabenold, MCZ). *Bolívar:* San Felix, Oct.–Dec. 1947, 1♀ (AMNH). COLOMBIA *Magdalena:* 10 km E Santa Marta, Oct. 1985, 1♀ (H.-G. Müller, SMF). *Atlántico:* Juan de Acosta, Finca Bella Lucilla, 60 m, Oct. 2000–Jan. 2001, 27♀, 3♂ (Y. Ow, D. Cuentes, ICNB AR-1952).

Mangora uraricoera new species
Figures 383–388; Map 5A

Holotype. Female holotype from Rio Uraricoera, Ilha de Maracá, Roraima, Brazil, 24 Mar. 1987 (A. A. Lise), in MCN 27430. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma

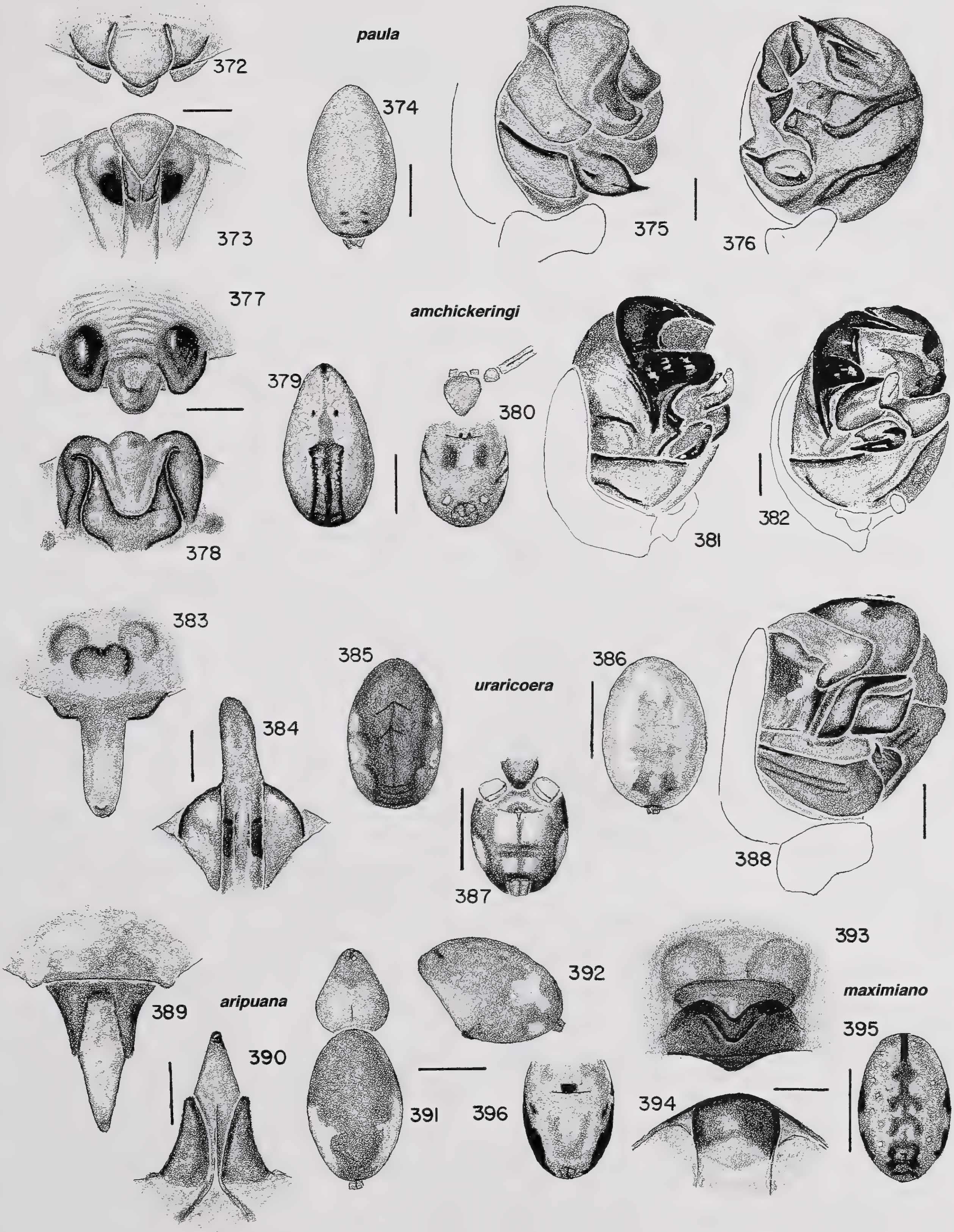
→

Figures 372–376. *Mangora paula* new species. 372–374, female. 372, 373, epigynum. 372, ventral; 373, posterior. 374, abdomen, dorsal. 375, 376, left male palpus 375, mesal; 376, ventral.

Figures 377–382. *M. amchickeringi* Levi. 377–380, female. 377, 378, epigynum. 377, ventral; 378, posterior. 379, abdomen, dorsal. 380, first femur, sternum, abdomen. 381, 382, male palpus 381, mesal; 382, ventral.

Figures 383–388. *M. uraricoera* new species. 383–387, female. 383, 384, epigynum. 383, ventral; 384, posterior. 385, 386, abdomen, dorsal. 387, sternum, abdomen. 388, male palpus, mesal.

Figures 389–392. *M. aripuana* new species, female. 389, 390, epigynum. 389, ventral; 390, posterior. 391, carapace, abdomen. 392, abdomen, lateral.



Figures 393–396. *M. maximiano* new species, female. 393, 394, epigynum. 393, ventral; 394, posterior. 395, abdomen, dorsal. 396, abdomen, ventral.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

yellowish, sternum black, coxae yellowish, legs with areas of gray. Abdomen: dorsum black (Fig. 385); venter marked with distinct white squares (Fig. 387); sides with white patches (Fig. 385). Posterior eye row recurved. Ocular quadrangle square. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 1.0 diameter apart, 1.0 from laterals. Posterior median eyes 0.9 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 2.5 mm. Carapace 1.1 mm long, 0.8 wide in thoracic region, 0.4 wide behind lateral eyes, 0.8 high. First femur 1.1 mm, patella and tibia 1.2, metatarsus 0.8, tarsus 0.4. Second patella and tibia 1.1 mm, third 0.8, fourth femur 1.2.

Male paratype. Posterior eye row recurved. Ocular quadrangle square. Posterior median eyes 0.9 diameter of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 0.8 diameter apart, 0.7 from laterals. Posterior median eyes 0.6 diameter apart, 1.0 from laterals. Height of clypeus equals 1.3 diameters of anterior median eyes. Total length 1.7 mm. Carapace 0.9 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.8 high. First femur 1.0 mm, patella and tibia 1.1, metatarsus 0.8, tarsus 0.4. Second patella and tibia 1.0 mm, third 0.7, fourth femur 1.0.

Males and females were collected together.

Variation. Total length of females 2.2 to 2.8 mm, males 1.7 to 1.8. The scape of the epigynum seems to originate anteriorly to the posterior edge of the epigynum (Figs. 383, 384). The terminal apophyses vary slightly in structure. Figures 385, 387 were made from a female from Roraima, Figure 386 from a female from Ecuador.

Diagnosis. The epigynum of *M. uraricoera*, unlike all others, has a long scape with parallel sides (Fig. 383) and, in posterior view, two longitudinal grooves with parallel sides (Fig. 384).

The male palpus, unlike others, has a prominent, straight, pointed embolus with its base located proximally (Fig. 388).

Natural History. Specimens have been found in forest interior, 80 km N Manaus, others in tierra firma forest in Vaupés, Colombia.

Distribution. Guianas and Amazon region (Map 5A).

Paratypes. BRAZIL *Roraima:* Rio Uraricoera, Ilha de Maracá, 14 Dec. 1987, 1♂ (E. H. Buckup, MCN 27441).

Specimens Examined. GUYANA Ikuruwa River, 5°70′N, 57°50′W, Aug., Dec. 1961, 2♀, 1♂ (G. Bentley, AMNH); Kaieteur, 14 Aug. 1911, 1♀ (F. E. Lutz, AMNH). SURINAME *Brokopondo Prov.:* Browns Berg, 5°N, 55°27′W [04°53′N, 55°13′W], 20 Feb. 1982, 1♀ (D. Smith Trail, MCZ). VENEZUELA *Amazonas:* Cerro de la Neblina, basecamp, 140 m, 0°50′N, 66°10′W, 21–28 Feb. 1985, 1♀ (W. F. Steiner, USNM). COLOMBIA *Vaupés:* Terassa, Lago Terassa, E. G. Capan, 01°04′S, 69°31′W, May 2002, 2♀, 1♂ (J. Pinzon, A. Schogal, ICNB); Baja Río Apaporis, Lago Taraira, Estación Biológica Caparú, 01°04′S, 69°31′W, Sep. 2002, 4♀, 4♂ (L. Benavides, ICNB AR-3332); Mpa. Taraira Serrania Taraira, Caño, Pintadillo, 01°01′S, 69°39′W, Mar. 2002, 5♀, 2♂ (J. Pinzón, ICNB AR-3333); Río Apaporis, Tarcala, E. O. Mosiro Itayure, 200 m, 01°04′S, 69°31′W, Oct. 2002, 3♀, 1♂ (L. Benavides, ICNB); Lago Taraira, Estación Biológica Caparú, 01°04′S, 69°31′W, May 2002, 1♀ (J. Pinzón, A. Schogal, ICNB). *Putumayo:* Parque Nacional Natural La Paya, June 2002, 1♂ (ICNB AR-3348). *Amazonas:* Laguna Matamata, 03°41S, 70°15′W, Nov. 2001, 1♀ (ICNB AR-3344c); Parque Nacional Natural Amacayacu, Laguna Matamata, 150 m, 03°41′S, 70°15′W, 2♀ (ICNB AR-3343); Corr. La Mathani, Quebradón El Ayo, 01°35′S 69°31′W, May 2002, 3♀, 3♂ (J. Ponzón, ICNB AR-3337, 3339). ECUADOR *Sucumbíos:* Río Tarapuy, 20 Feb. 1984, 1♀ (L. Avilés, MECN). PERU *Loreto:* Centro de Investigacion "Jenaro Herrera", 04°55′S, 73°45′W, 26–27 Aug. 1988, 1♀, 1♂ (D. Silva D., MUSM). *Cuzco:* Camisea, Cashiriari, 690 m, 11°52′S, 72°39′W, 30 Nov. 1997, 1♀ (J. Duarez C., MUSM). BRAZIL *Amazonas:* Manaus, Reserva Florestal Adolpho Ducke, 18–25 Feb. 1992, 1♀ (A. D. Brescovit, MCN 22088); 19–24 Feb. 1992, 1♀ (A. A. Lise, MCP 1730); 80 km N Manaus, Colosso Reserve, 28 May 1990, 1♀; 25 Oct. 1989, 1♀ (H. G. Fowler et al., HGF); 80 km N Manaus, C. de Powell Reserve, 20 Apr. 1991, 1♀ (H.G. Fowler et al., IBSP); Maturucá, São Gabriel da Cachoeira, 12 Oct. 1990, 1♀ (A. A. Lise, MCP 1254); near Manaus, km 41 Reserve, 12 Mar. 1991, 1♀, 1♂; 18 Apr. 1991, 1♀ (H. G. Fowler et al., INPA, MCZ); Manaus, Fazenda Esteio, Reserva km 41, 12 Jan. 1994, 1♀ (A. D. Brescovit, MCN, 25138).

Mangora aripuana new species
Figures 389–392; Map 4E

Holotype. Female holotype from Aripuana, Mato Grosso, Brazil, 1979 (W. and L. Miller), in MCZ. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellow, area between median eyes black; cephalic area darker yellow (Fig. 391); endites, labium, sternum black. Legs grayish yellow, first three femora darkest, except for their ends, and a narrow black ring around distal end of tibiae. Abdomen: black, except for lighter lateral areas and two patches without pigment anterior to spinnerets (Figs. 391, 392). Posterior eye row straight. Ocular quadrangle square. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.8 diameter apart, 0.3 from laterals. Posterior median eyes 0.8 diameter apart, 1.0 from laterals. Height of clypeus equals 1.1 diameters of anterior median eyes. Total length ca. 2.3 mm. Carapace 1.1 mm long, 0.9 wide in thoracic region, 0.3 wide behind lateral eyes, 0.8 high. First femur 1.1 mm, patella and tibia 1.2, metatarsus 0.8, tarsus [lost]. Second patella and tibia 1.0 mm, third 0.7, fourth 1.1.

The male is unknown.

Diagnosis. Mangora aripuana epigynum, unlike that of *M. uraricoera* (Fig. 383), has a pointed scape between two bracts (Figs. 389, 390). The median plate in posterior view, a continuation of the scape, is narrow dorsally (Fig. 390).

Natural History. The specimen was collected in forest.

Distribution. Only known from upper Amazon region in Mato Grosso, Brazil (Map 4E).

Specimens Examined. No other specimens were found.

Mangora maximiano new species
Figures 393–396; Map 4F

Holotype. Female holotype from Fazenda São Maximiano, Guaíba, Rio Grande do Sul, Brazil, 2 June 1995 (A. A. Lise et al.), in MCP 6712. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellowish with black eye rings. Abdomen: dorsum with median gray to black marks (Fig. 395); venter with indistinct gray U-shaped mark (Fig. 396); sides with a black patch (Fig. 396). Abdomen posterior widest (Fig. 395). Posterior eye row slightly procurved. Ocular quadrangle longer than wide, rectangular. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 1.0 diameter apart, 0.8 from laterals. Posterior median eyes 0.5 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 2.8 mm. Carapace 1.2 mm long, 0.9 wide in thoracic region, 0.4 wide behind lateral eyes, 0.7 high. First femur 1.2 mm, patella and tibia 1.3, metatarsus 1.2, tarsus 0.4. Second patella and tibia 1.2 mm, third 0.8, fourth 1.2.

The male is unknown.

Diagnosis. Mangora maximiano epigynum differs from others by having a wide lobed scape (Fig. 393); the posterior view has a short, swollen, wide median plate (Fig. 394).

Distribution. Only known from southern Brazil (Map 4F).

Specimens Examined. No other specimens have been found.

Mangora barba new species
Figures 397–400; Map 5B

Holotype. Female holotype and one female paratype from Barbacoas, 20 m, Nariño, Colombia, 20 Mar. 1974 (W. Eberhard 738), in MCZ. The specific name is a noun in apposition, an arbitrary combination of letters. "Barba" is Spanish for "beard".

Description. Female holotype. Carapace light orange, with a black patch between median eyes, lateral eyes on gray, a gray patch in center behind median eyes (Fig. 400). Clypeus orange. Chelicerae orange; labium, endites gray. Sternum with gray edge. Legs light orange, distal leg articles gray. Abdomen: dorsum with pairs of

white patches separated by anterior black areas, posterior gray; the second light patch continuous with other patches on sides of abdomen (Fig. 400); venter gray, blackish on sides and black anterior to spinnerets. Posterior eye row strongly procurved. Ocular quadrangle longer than wide, posterior widest. Posterior median eyes 1.4 diameters of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes their diameter apart, 0.3 from laterals. Posterior median eyes 0.6 diameter apart, 0.5 from laterals. Height of clypeus equals 0.5 diameter of anterior median eyes. Total length 3.2 mm. Carapace 1.6 mm long, 1.3 wide in thoracic region, 0.7 wide behind lateral eyes, 0.8 high. First femur 1.7 mm, patella and tibia 1.9, metatarsus 1.6, tarsus 0.8. Second patella and tibia 1.8 mm, third 1.2. Fourth femur 1.8 mm, patella and tibia 1.8, metatarsus 1.6, tarsus 0.7.

The male is unknown.

Diagnosis. Mangora barba has unusually large eyes, with anterior median eyes facing slightly ventrally. The epigynum is heavily sclerotized and is distinguished from others by its projecting shelf (Figs. 397–399); the lateral view is from slightly anterior (Fig. 399).

Distribution. Only known from southwestern Colombia (Map 5B).

Specimens Examined. No other specimens were found.

Mangora argenteostriata Simon
Figures 401–404; Map 4A

Mangora argenteostriata Simon, 1896: 478. Female holotype from Teffe [Tefé, Amazonas, Brazil], in MNHN no. 1445. When examining the specimen in 1971, I labeled it as a type. Platnick, 2006.

Description. Female holotype. Prosoma orange-yellow; large black circles around secondary eyes. Abdomen: dorsum with silver spots and gray pigment patches (Fig. 404). Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.7 diameter apart, 0.7 from laterals. Posterior median eyes 0.6 diameter apart, 0.6 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Total length 4.8 mm. Carapace 1.7 mm long, 1.4 wide in thoracic region. First femur 2.2 mm, patella and tibia 2.5, metatarsus 1.9, tarsus 0.8. Second patella and tibia 2.3 mm, third 1.3, fourth 2.3

The male is unknown.

Diagnosis. In ventral view, the epigynum of *M. argenteostriata* projects ventrally (Fig. 403) and on its ventral face shows a curved slit, the anterior lip of a slight depression (Fig. 401); the rim in posterior view has a pair of angular projections (Fig. 402).

Distribution. Only known from the Amazon region (Map 4A).

Specimens Examined. No other specimens have been collected.

Mangora castelo new species
Figures 405–409; Map 4F

Holotype. Female holotype and two male paratypes from Castelo, Espírito Santo, Brazil, Nov. 1976 (M. Alvarenga), in AMNH. The specific name is a noun in apposition after the type locality. The word "castelo" is Portuguese for "castle".

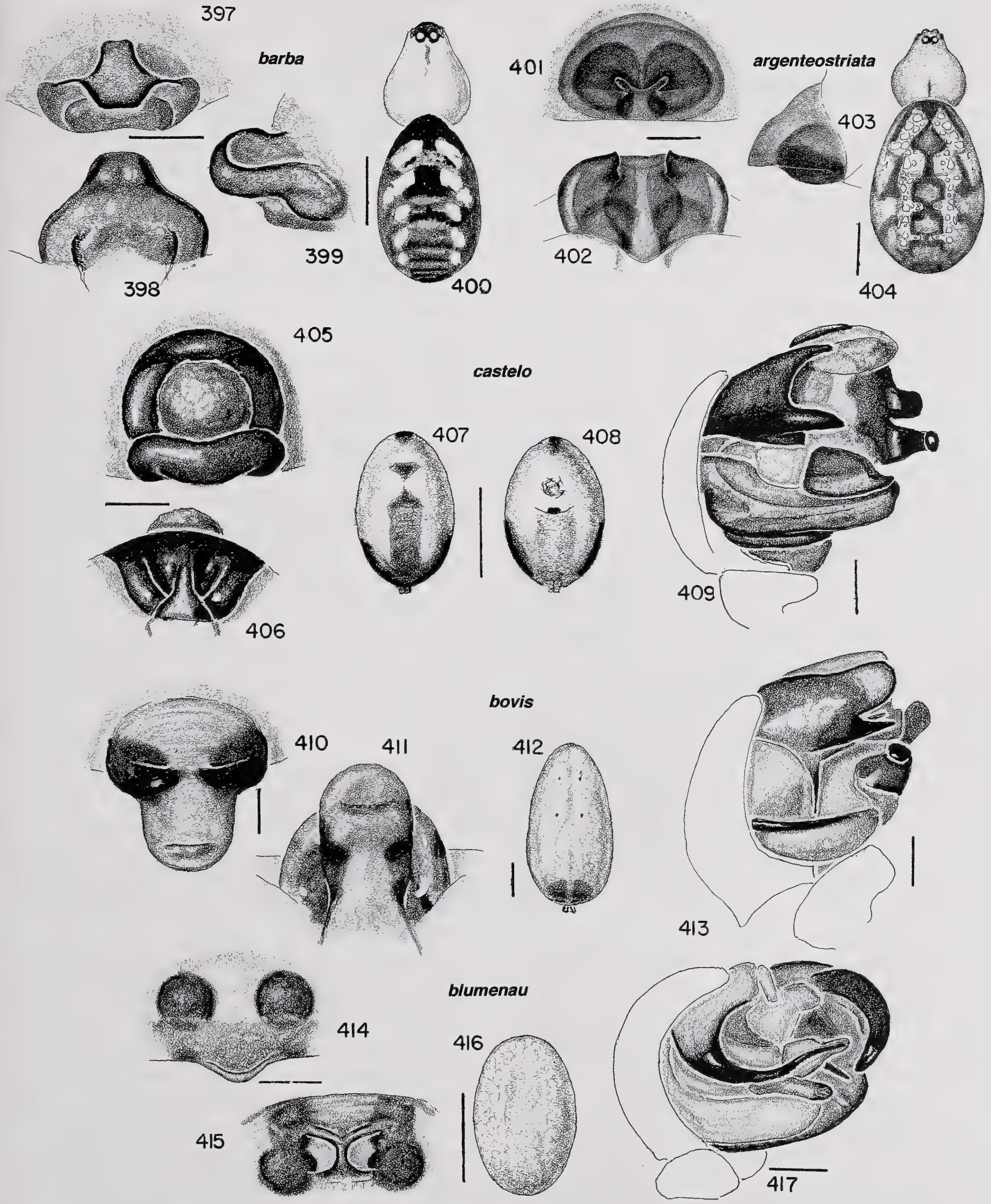
Description. Female holotype [in poor, shriveled condition]. Prosoma orange. Abdomen: dorsum with posterior median band (Fig. 407); venter with central gray area (Fig. 408), spinnerets gray; sides with

→

Figures 397–400. *Mangora barba* new species, female. 397–399, epigynum. 397, ventral; 398, posterior; 399, lateral. 400, carapace, abdomen.

Figures 401–404. *M. argenteostriata* Simon, female. 401–403, epigynum. 401, ventral; 402, posterior; 403, lateral. 404, carapace, abdomen.

Figures 405–409. *M. castelo* new species. 405–408, female. 405, 406, epigynum. 405, ventral; 406, posterior. 407, abdomen, dorsal. 408, abdomen, ventral. 409, left male palpus, mesal.



Figures 410–413. *M. bovis* new species. 410–412, female. 410, 411, epigynum. 410, ventral; 411, posterior. 412, abdomen, dorsal. 413, male palpus, mesal.

Figures 414–417. *M. blumenau* new species. 414–416, female. 414, 415, epigynum. 414, ventral; 415, posterior. 416, abdomen, dorsal. 417, male palpus, mesal.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

posterior gray patches. Posterior eye row slightly recurved. Ocular quadrangle slightly longer than wide, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.6 diameter apart, 0.5 from laterals. Posterior median eyes 0.4 diameter apart, 1.2 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Total length ca. 2.8 mm. Carapace 1.0 mm long [width and height damaged]. First femur 1.3 mm, patella and tibia 1.4, metatarsus 1.2, tarsus 0.6. Second patella and tibia 1.3 mm, third 0.8, fourth 1.2.

Male paratype [damaged]. Few abdominal markings. Posterior eye row slightly recurved. Ocular quadrangle slightly longer than wide, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 1.1 diameters apart, 1.0 from laterals. Posterior median eyes 1.2 diameters apart, 1.0 from laterals. Height of clypeus equals 1.2 diameters of anterior median eyes. Total length ca. 2.2 mm. Carapace 1.3 mm long, 1.1 wide in thoracic region, 0.4 wide behind lateral eyes, 0.7 high. First femur 1.3 mm, patella and tibia 1.4, metatarsus 1.0, tarsus 0.6. Second patella and tibia 1.3 mm, third 0.7, fourth 1.3.

Males and females have been collected together.

Diagnosis. Mangora castelo epigynum, unlike that of any other species, has a framed hemisphere (Fig. 405); the posterior view has two openings in triangular depressions separated by an upside-down T-shaped septum (Fig. 406).

The male palpus has a triangular median apophysis pointed at its distal tip (4 h in Fig. 409). The median sclerotized sclerite with a pointed spine, which might be the embolus (Fig. 409), is not seen in any other species.

Distribution. Only known from Espírito Santo, in southeastern Brazil (Map 4F).

Specimens Examined. No other specimens have been collected.

Mangora bovis new species
Figures 410–413; Map 4E

Holotype. Female holotype from Cannister Falls, British Guiana [Guyana], Cattle Trail Survey, June 1920 (A. A. Abraham), in BMNH 1923.7.23.70. The specific name is a noun in apposition after the name of the expedition.

Description. Female holotype. Prosoma yellow. Abdomen: whitish; dorsum with white spots, a pair of posterior gray patches (Fig. 412); venter with two longitudinal rows of white spots. Posterior eye row recurved. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.7 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.6 diameter apart, 0.6 from laterals. Posterior median eyes 0.3 diameter apart, 1.5 from laterals. Height of clypeus equals 0.7 diameter of anterior median eyes. First legs almost the same length as fourth. Total length 6.2 mm. Carapace 2.5 mm long, 2.0 wide in thoracic region, 0.8 wide behind lateral eyes, 1.3 high. First femur 2.8 mm, patella and tibia 3.1, metatarsus 2.7, tarsus 0.9. Second patella and tibia [lost], third 1.8 mm, fourth, 3.1.

Male from Manaus. Abdomen: with a pair of small black patches anterior to posterior dorsal larger black patches. Posterior eye row procurved. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.7 diameter of anterior medians; lateral eyes 0.4 diameter. Anterior median eyes 0.3 their diameter apart, 0.2 from laterals. Posterior median eyes 0.5 diameter apart, 1.2 from laterals. Height of clypeus equals 0.3 diameter of anterior median eyes. Fourth femur with a proximal, ventral strong macroseta on a slight lobe. Total length 3.3 mm. Carapace 1.6 mm long, 1.3 wide in thoracic region, 0.5 wide behind lateral eyes, 0.8 high. First femur 1.8 mm, patella and tibia 2.2, metatarsus 1.9, tarsus 0.7; second 1.9 mm third 1.2, fourth, 1.8.

Males and females were collected together in Brazil.

Variation. Total length of females 5.4 to 6.5 mm, males 3.3 to 6.4. The illustrations

were made from the female holotype and a male from Manaus.

Diagnosis. The wide, parallel-sided scape of the epigynum with rounded end and two anterior dark areas (Figs. 410, 411) is unlike that of any other species.

The male palpus has a lobe above its pointed embolus (Fig. 413). Unlike that of *M. apaporis* (Fig. 423), the embolus spine is straight, and unlike that of *M. tambo* (Fig. 131), it is short, straight, and sclerotized.

Natural History. Specimens from near Manaus have been found in the interior of forests.

Distribution. Guyana and Amazon region of Brazil (Map 4E).

Specimens Examined. BRAZIL *Pará:* Aveiro, 30 Oct. 1970, 1♂ (EPA, MZSP JJ 620). *Amazonas:* Manaus, Reserva Florestal Adolpho Ducke, 3 Aug. 1987, 3♀, 1♂ (A. A. Lise, MCN 27439, 27436); 18 Dec. 1987, 2♀ (A. A. Lise, MCN 27427); 15 Aug. 1991, 1♀ (A. D. Brescovit, MCN 21393); 80 km N Manaus, Colosso Reserve, 5 Feb. 1990, 1♀ (IBSP); 22 Mar. 1990, 2♀ (H. G. Fowler, MCN); 5 Apr. 1990, 2♀ (INPA, MCZ); 19 Apr. 1990, 1♀; 6 June 1991, 1♀ (H. G. Fowler et al., MCZ); ca. 80 km N Manaus, Cabo Frio Reserve, 16 May 1990, 1♀ (H. G. Fowler, INPA); near Manaus, km 41 Reserve, 17 Apr. 1991, 1♀ (H. G. Fowler et al., MCZ); Borba, Rio Mapiá, 22 Apr. 1996, 2♀ (IBSP, SMNK staff, IBSP 15978). *Rondônia:* Pimenta Bueno, July 1999, 1♀ (G. Christianini, IBSP 23955).

Mangora blumenau new species
Figures 414–417; Map 4F

Holotype. Female holotype from Blumenau, Santa Catarina, 27°00′S, 43°00′W, Brazil, 3 Feb. 1996 (A. Bonaldo, A. B. Kury), in MCN 27248. The specific name is a noun in apposition after the type locality. The name is a German word for "flower meadow".

Description. Female holotype. Prosoma yellowish white. Abdomen: white, dorsum with white pigment spots (Fig. 416). Posterior eye row straight. Ocular quadrangle slightly longer than wide, anterior widest. Posterior median eyes 1.1 diameters of anterior medians; lateral eyes 0.9 diameter. Anterior median eyes 1.0 diameter apart, 1.0 from laterals. Posterior median eyes 0.5 diameter apart, 1.2 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 2.7 mm. Carapace 1.1 mm long, 0.8 wide in thoracic region, 0.4 wide behind lateral eyes, 0.6 high. First femur 1.3 mm, patella and tibia 1.5, metatarsus 1.2, tarsus 0.5. Second patella and tibia 1.4 mm, third 0.7, fourth 1.2.

Male from Boracéia-Salesópolis. Coloration as in female. Posterior eye row procurved. Ocular quadrangle slightly longer than wide, rectangular. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 1.0 diameter apart, 1.0 from laterals. Posterior median eyes 0.5 diameter apart, 1.0 from laterals. Height of clypeus equals 1.2 diameters of anterior median eyes. Total length 2.1 mm. Carapace 1.0 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 1.1 high. First femur 1.0 mm, patella and tibia 1.3, metatarsus 0.9, tarsus 0.5. Second patella and tibia 1.0 mm, third 0.7, fourth 1.1.

Males and females have been collected together.

Variation. Total length of females 2.6 to 2.8 mm, males 1.6 to 2.3.

Diagnosis. Mangora blumenau epigynum in ventral view has spermathecae almost their diameter apart (Fig. 414); in posterior view, the epigynum resembles that of *M. balbina* (Fig. 261) and *M. ramirezi* (Fig. 297), but the pair of depressions are farther from the ventral rim (Fig. 415).

The male palpus resembles that of *M. ordaz* (Fig. 197), but the embolus is wider and the terminal apophysis differs in shape (Fig. 417).

Distribution. Rio de Janeiro to Santa Catarina, southern Brazil (Map 4F).

Specimens Examined. BRAZIL *Rio de Janeiro:* Teresópolis, 900–1,100 m, 7–9 Nov. 1945, 1♂ (H. Sick, AMNH). *São Paulo:* Salesópolis, Estação Biológica de Boracéia, 6–9 July 1948, 5♀, 3♂ (H. Camargo, MZSP 3249); 18 Oct. 1960, 1♀ (K. Lenko, MZSP 13248); 13, 14 Apr. 1961, 1♀ (P. de Biasi); 22–23 Feb. 1961, 1♂ (P. de Biasi, MZSP 13247); 15 June 1964, 1♂ (Oliveira, MZSP 5413); 23 Sep. 1965, 1♀ (P. de Biasi, MZSP 4849); 28 Feb. 1967, 1♀(P. de Biasi, MZSP 6122a); Cotia, Dec. 2002, 1♀, 2♂ (A. A. Nogueira,

D. Lahr, MZSP); Paranápiacaba, Estação Ecológica do Alto da Serra, 29 Oct. 1990, 1♂ (R. Baptista, MZSP 12001). *Paraná:* Palmeira, 1 Oct. 1994, 1♀ (R. Bóçon, MCN 26611); São José dos Pinhais, Serra da Farinha Seca, 15–20 Sep. 1995, 1♀, 6♂ (Lab. de Arachnol, MCP 7627, 7655); 15–29 Nov. 1995, 1♀ (A. A. Lise et al., MCP 7617).

Mangora anilensis new species
Figure 418–421; Map 4G

Holotype. Male holotype from Parque Nacional da Serra do Divisor, Acre, Brazil, 23 Mar. 1997 (L. Resende, R. Vieira) in IBSP 12400. The specific name is an adjective of a locality in the park.

Description. Male holotype. Yellowish white. Abdomen: dorsum with three black marks and paired gray and posterior black marks (Fig. 418, 419); sides with white pigment spots and posterior gray; venter with indistinct light gray median area (Fig. 419). Posterior eye row procurved. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.6 diameter of anterior medians; lateral eyes 0.4 diameter. Anterior median eyes 1.0 diameter apart, 0.2 from laterals. Posterior median eyes 1.0 diameter apart, 1.2 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Fourth femur with a proximal, ventral macroseta. Total length 3.3 mm. Carapace 1.3 mm long, 1.2 wide in thoracic region, 0.4 wide behind lateral eyes, 0.6 high. First femur 1.6 mm, patella and tibia 1.6, metatarsus 1.1, tarsus 0.7. Second patella and tibia 1.5 mm, third 0.8, fourth 1.4.

The female is not known.

Diagnosis. Mangora anilensis is marked with spots on the abdomen (Figs. 418, 419), and the palpus differs from others by having a sclerotized conductor with a triangular point directed toward the median apophysis (Fig. 420).

Distribution. Known only from upper Amazon: western Brazil (Map 4G).

Specimens Examined. No other specimens have been collected.

Mangora apaporis new species
Figures 422, 423; Map 4G

Holotype. Male holotype from Río Pira and Río Apaporis, 0°25′S, 70°15′W, Amazonas, Colombia, 6–16 Feb. 1989 (V. and B. Roth) in CAS. The specific name is a noun in apposition after the type locality.

Description. Male holotype. Prosoma yellowish, with eye region black and sides of thoracic region gray. Abdomen: dorsum white with black patches (Fig. 422); venter without marks. Posterior eye row procurved. Ocular quadrangle longer than wide, rectangular. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.6 diameter apart, 0.2 from laterals. Posterior median eyes 0.6 diameter apart, 0.6 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Fourth femur with a proximal, ventral macroseta. Total length 2.5 mm. Carapace 1.3 mm long, 1.1 wide in thoracic region, 0.4 wide behind lateral eyes, 0.6 high. [First and second legs lost.] Third patella and tibia 0.8 mm, fourth 1.3.

The female is not known.

Variation. Total length of males 2.5 to 2.7.

Diagnosis. Unlike the similar *M. tambo* (Fig. 131), *M. bovis* (Fig. 413), and *M. leticia* (Fig. 429), the *M. apaporis* palpus has a curved, pointed embolus, its tip hidden by the adjacent lobe (Fig. 423).

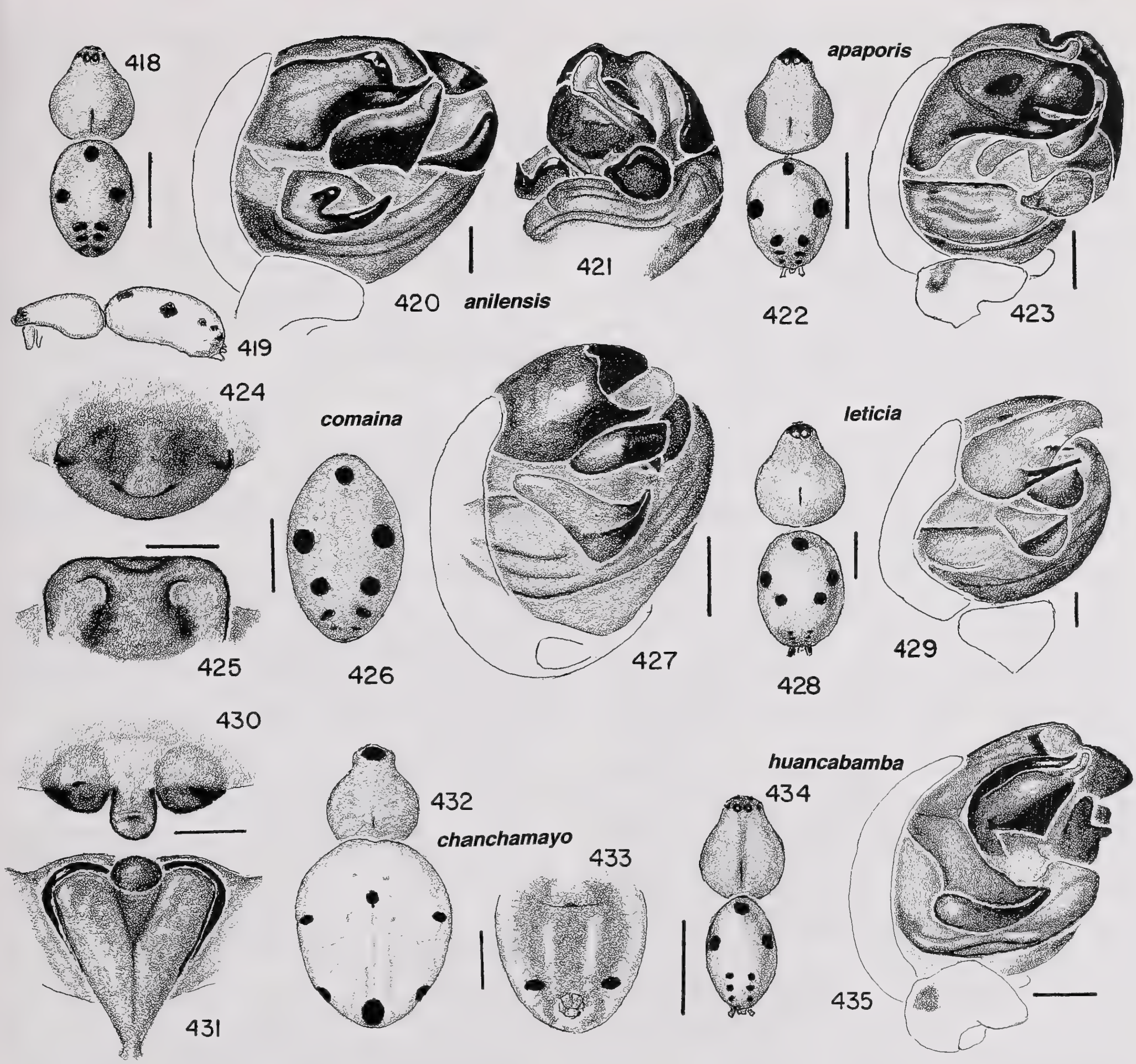
Distribution. Upper Amazon region, Colombia and northern Peru (Map 4G).

Specimens Examined. PERU *Loreto:* Jenaro Herrera, 100 m, 04°45′S, 73°45′W, 28 Aug. 1988, 1♂ (D. Silva D., MUSM).

Mangora comaina new species
Figures 424–427; Map 4G

Holotype. Female holotype, one male and six female paratypes from Cordillera del Cóndor, Alto Río Comaina, Puesto de Vigilancia 22, 900–1,150 m, Amazonas, Peru, 30 Oct. 1987 (D. Silva D.), in MUSM. The specific name is a noun in apposition after the name of the type locality.

Description. Female paratype. Prosoma orange, median eye region gray. Abdomen: dorsum with seven round, black patches (Fig. 426). Posterior eye row procurved. Ocular quadrangle slightly longer than wide, posterior slightly widest. Posterior



Figures 418–421. *Mangora anilensis* new species, male. 418, carapace, abdomen, dorsal. 419, carapace, chelicerae, abdomen, lateral. 420, 421, left palpus, 420, mesal; 421 ventral.

Figures 422, 423. *M. apaporis* new species, male. 422, carapace, abdomen. 423, palpus, mesal.

Figures 424–427. *M. comaina* new species. 424–426, female. 424, 425, epigynum. 424, ventral; 425, posterior. 426, abdomen, dorsal. 427, male palpus, mesal.

Figures 428, 429. *M. leticia* new species, male. 428. carapace, abdomen. 429, palpus, mesal.

Figures 430–433. *M. chanchamayo* new species, female. 430–431, epigynum. 430, ventral; 431, posterior. 432, carapace, abdomen. 433, abdomen, ventral.

Figures 434, 435. *M. huancabamba* new species, male. 434, carapace, abdomen. 435, palpus, mesal.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

median eyes 1.4 diameters of anterior medians; lateral eyes 0.7 diameters. Anterior median eyes 1.2 diameters apart, 0.5 from laterals. Posterior median eyes 0.9 diameter apart, 0.8 from laterals. Height of clypeus equals 0.3 diameter of anterior median eyes. Total length 3.2 mm. Carapace 1.3 mm long, 1.1 wide in thoracic region, 0.4 wide behind lateral eyes, 0.6 high. First femur 1.4 mm, patella and tibia 1.5, meta-

tarsus 1.1, tarsus 0.6. Second patella and tibia 1.4 mm, third 0.8, fourth 1.3.

Male paratype. Coloration as in female. Posterior eye row procurved. Ocular quadrangle slightly longer than wide, anterior slightly widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.4 diameter. Anterior median eyes 0.7 diameter apart, 0.2 from laterals. Posterior median eyes 0.8 diameter apart, 0.8 from laterals. Height of clypeus equals 0.3 diameter of anterior median eyes. Fourth femur with proximal, ventral macroseta. Total length 2.3 mm. Carapace 1.2 mm long, 1.0 wide in thoracic region, 0.3 wide behind lateral eyes, 0.7 high. First femur 1.4 mm, patella and tibia 1.5, metatarsus 1.2, tarsus 0.6. Second patella and tibia 1.3 mm, third 0.7, fourth 1.3.

Males and females were collected together and have similar markings.

Variation. Total length of females 3.0 to 3.5 mm.

Diagnosis. The abdomen of *M. comaina* has two more spots than the other spotted species (Fig. 426); unlike other species with round spots, the epigynum rim is a rounded lobe (Fig. 424); posteriorly there are two circular openings close to the ventral margin (Fig. 425).

The male palpus is distinguished by the shape of the embolus and its adjacent rectangular conductor and the single spine of the median apophysis (Fig. 427).

Natural History. The specimens came from primary rain forest.

Distribution. Only known from upper Amazon region, northern Peru (Map 4G).

Specimens Examined. No other specimens have been collected.

Mangora leticia new species
Figures 428, 429; Map 4G

Holotype. Male holotype from Leticia, Amazonas, Colombia, 20 Jan. 1965 (P. R. Craig, J. Robb), in CAS. The specific name is a noun in apposition after the type locality.

Description. Male holotype. Prosoma yellowish, except eye region black. Abdomen: white; dorsum with black patches (Fig. 428); venter not marked. Posterior eye row procurved. Ocular quadrangle longer than wide, rectangular. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 0.7 diameter apart, 0.7 from laterals. Posterior median eyes 0.7 diameter apart, 0.7 from laterals. Height of clypeus equals 1.3 diameters of anterior median eyes. Fourth femur with proximal, ventral macroseta on left leg only. Total length 2.5 mm. Carapace 1.1 mm long, 0.9 wide in thoracic region, 0.3 wide behind lateral eyes, 0.4 high. First femur 1.2 mm, patella and tibia 1.3, metatarsus 1.0, tarsus 0.6. Second patella and tibia 1.2 mm, third 0.6, fourth 1.1.

The female is not known.

Diagnosis. The *M. leticia* palpus, unlike that of *M. apaporis* (Fig. 423) and *M. bovis* (Fig. 413), has the lobe above the pointed embolus elongated and distally bent (Fig. 429).

Distribution. Only known from upper Amazon: Colombia (Map 4G).

Specimens Examined. No other specimens have been collected

Mangora chanchamayo new species
Figures 430–433; Map 3D

Holotype. Female holotype from Chanchamayo [10°55′S, 75°18′W, Junín], Peru, Aug. 1941 (F. Weyrauch), in CAS. The specific name is a noun in apposition after the name of the type locality.

Description. Female holotype. Prosoma orange, with black eye region. Abdomen: dorsum white, with six black patches (Fig. 432); venter with two median white bands (Fig. 433). Posterior eye row procurved. Ocular quadrangle square. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 1.0 diameter apart, 1.0 from laterals. Posterior median eyes 1.0 diameter apart, 1.3 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 4.7 mm. Carapace 1.8 mm long, 1.4 wide in thoracic region, 0.6 wide behind lateral eyes, 0.7 high. First femur 1.8 mm, patella and tibia 1.9, meta-

tarsus 1.6, tarsus 0.8. Second patella and tibia 1.8 mm, third 1.1, fourth 1.8.

The male is not known.

Diagnosis. Mangora chanchamayo, unlike other species with spots, lacks the anterior median spot (Fig. 432). Females have an epigynum with a narrow scape, which is as long as wide (Fig. 430), and in posterior view, a distinctive, elongate, heart-shaped median plate (Fig. 431) that is distinct from that of *M. mathani* (Figs. 437, 439).

Distribution. Upper Amazon region, only known from central Peru (Map 3D).

Specimens Examined. No other specimens have been collected.

Mangora huancabamba new species
Figures 434, 435; Map 5D

Holotype. Male holotype and immature female from Quebrada Castillo, NW de Iscozacin, 345 m, Huancabamba, 10°10′S, 75°15′W, Pasco, Peru, 8 Sep. 1989 (D. Silva D.), in MUSM. The specific name is a noun in apposition after the type locality.

Description. Male holotype. Prosoma orange-yellow, carapace with an indistinct gray median band. Abdomen: dorsum with nine black patches (Fig. 434). Posterior eye row procurved. Ocular quadrangle as long as anterior width, anterior slightly widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.8 diameter apart, 0.3 from laterals. Posterior median eyes 0.6 diameter apart, 1.0 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Fourth femur with a ventral, proximal macroseta (as in Fig. 21). Total length 2.3 mm. Carapace 1.3 mm long, 1.1 wide in thoracic region, 0.3 wide behind lateral eyes, 0.7 high. First femur 1.4 mm, patella and tibia 1.6, metatarsus 1.2, tarsus 0.7. Second patella and tibia 1.4 mm, third 0.8, fourth 1.3.

The female is not known.

Diagnosis. The male of *M. huancabamba* palpus (Fig. 435) differs from that of *M. anilensis* (Fig. 420) by lacking the proximal spur of the median apophysis and having a different shape.

Distribution. Only known from upper Amazon: central Peru (Map 5D).

Specimens Examined. No other specimens have been collected.

Mangora mathani Simon
Figures 436–449, 541, 542; Map 4H

Mangora mathani Simon, 1895: 787. Female syntypes from Iquitos [Peru] and São Paulo [de Olivença, Amazonas, Brazil], (M. de Mathan), in MNHN, examined.

Note. This species is listed in Roewer's (1942: 774) catalog. Despite the presence of a description in Simon, it is cited as nomen nudum in Bonnet (1957: 2710) and Platnick (2006).

Additional specimens from the type locality in the MNHN were labeled *M. 5-punctata* by Simon.

Description. Female from Tambopata, Peru. Prosoma light orange. Abdomen: orange-white with dorsal white pigment spots and three black spots and three pairs of black spots (Fig. 445); venter without white spots. Posterior eye row procurved. Ocular quadrangle longer than wide, rectangular. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.5 diameter apart, 0.3 from laterals. Posterior median eyes 0.8 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 3.6 mm. Carapace 1.7 mm long, 1.3 wide in thoracic region, 0.7 wide behind lateral eyes, 0.7 high. First femur 1.8 mm, patella and tibia 2.1, metatarsus 1.7, tarsus 0.8. Second patella and tibia 1.8 mm, third 1.3, fourth 2.0 mm.

Male from Napo Prov., Ecuador. Coloration as in female. Posterior eye row procurved. Ocular quadrangle longer than wide, rectangular. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.5 diameter apart, 0.4 from laterals. Posterior median eyes 0.8 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. The fourth femur has a ventral, proximal macroseta (as in Fig. 21). Total length 2.2

mm. Carapace 1.2 mm long, 1.1 wide in thoracic region, 0.4 wide behind lateral eyes, 0.7 high. First femur 1.3 mm, patella and tibia 1.6, metatarsus 1.3, tarsus 0.7. Second patella and tibia 1.2 mm, third 0.7, fourth 1.3.

Males and females have been collected together.

Variation. Total length of females 3.6 to 4.6 mm, males 2.2 to 2.6. The epigyna of some females have their tips torn off (Figs. 442, 443). Figures 436, 437, 445 were made from syntypes. Figures 438, 439, 444 were made from a female from Peru, others from specimens from Colombia, except Figures 541, 542, which were made from a female from Iquitos, Peru, first thought to be a separate species.

Diagnosis. The *M. mathani* is distinguished from other species with the black-spotted abdomen (Fig. 445) by the posterior view of the epigynum, which shows a pair of dorsal diagonal pockets (Figs. 437, 439, 441, 444, 542).

Unlike *M. anilensis* (Fig. 420), *M. apaporis* (Fig. 423), *M. leticia* (Fig. 429), and *M. novempupillata* (Fig. 456), the male palpus of *M. mathani* (Figs. 447, 448, 449) has an embolus supported by a truncate, sclerotized conductor bearing a black ventral shield resembling that of *M. pira* (Fig. 36).

Natural History. Specimens have been collected from primary forest in Depto. Guainía, Colombia, and from igapo forest (seasonally flooded forest) and tierra firma forest in Colombia.

Distribution. Upper Amazon: one record from the central Amazon region (Map 4H).

Specimens Examined. COLOMBIA *Guainía:* Inírida, Comunidad Indigena Chorro Bocon, 150 m, Sep. 2003, 1♀ (H. Pulido, ICNB AR-3428). *Vaupés:* Bajo Río Apaporis, Lago Taraira, E. B. Masiro, Estación Biológica Caparú, 200 m, 01°04′S, 69°31′W, Oct. 2002, 1♀ (L. Benavides, ICNB AR-3330); Mpo. Taraira, Serr. Taraira, Caño Pintadillo, 01°01′S, 69°39′W, Mar. 2002, 4♀, 2 imm. (J. Pinzón, ICNB AR-3333). *Amazonas:* Río Pira and Apaporis, 0°25′S, 70°15′W, 7–16 Feb. 1989, 1♂ (V., B. Roth, CAS); Parque Nacional Natural Amacayacu, Laguna Matamata, 03°41′S, 70°15′W, Nov. 2001, 1♀ (ICNB AR-3344); Quebredón El Ayo, La Mathani, 01°35′S, 69°31′W, May 2002, 1♀, 1♂ (J. Pinzón, ICNB AR-3337). ECUADOR *Sucumbíos:* Río Tarapuy, 20 Feb. 1984, 1♀, 1♂ (L. Avilés, MECN); R. F. Cuyabeno, Ecuador 25 July–6 Aug. 1985, 1♀ (M. E. Ordobez, MECN); R. F. Cuyabeno, Lago Grande, 13 Feb. 1989, 3♀ (L. Avilés, MECN). PERU *Loreto:* Iquitos, 1920 (H. S. Parrish, MCZ). *Huánuco:* Dantas, La Molina, SW de Puerto Inca, 270 m, 09°38′S, 75°00′W, 18 May–1 June 1987, 5♀ (D. Silva D., MUSM). *Madre de Dios:* Zona Reservada Tambopata, 290 m, 12°50′S, 69°17′W, 4 June–3 July 1988, 1♀ (D. Silva D., MCZ). BRAZIL *Amazonas:* Manicoré, Rio Atininga, 19 Apr. 1996, 1♀ (IBSP/SMNK, IBSP 15432); Tefé, Fonte Boa, São Paulo de Olivença. pre 1880, 3♀, 2♂ (M. de Mathan, MNHN). *Acre:* Parque Nacional da Serra do Divisor, 10 Nov. 1996, 1♀ (R. S. Vieira, IBSP 9502); 14 Mar. 1997, 3♀ (L. Resende, R. Vieira, IBSP 12611).

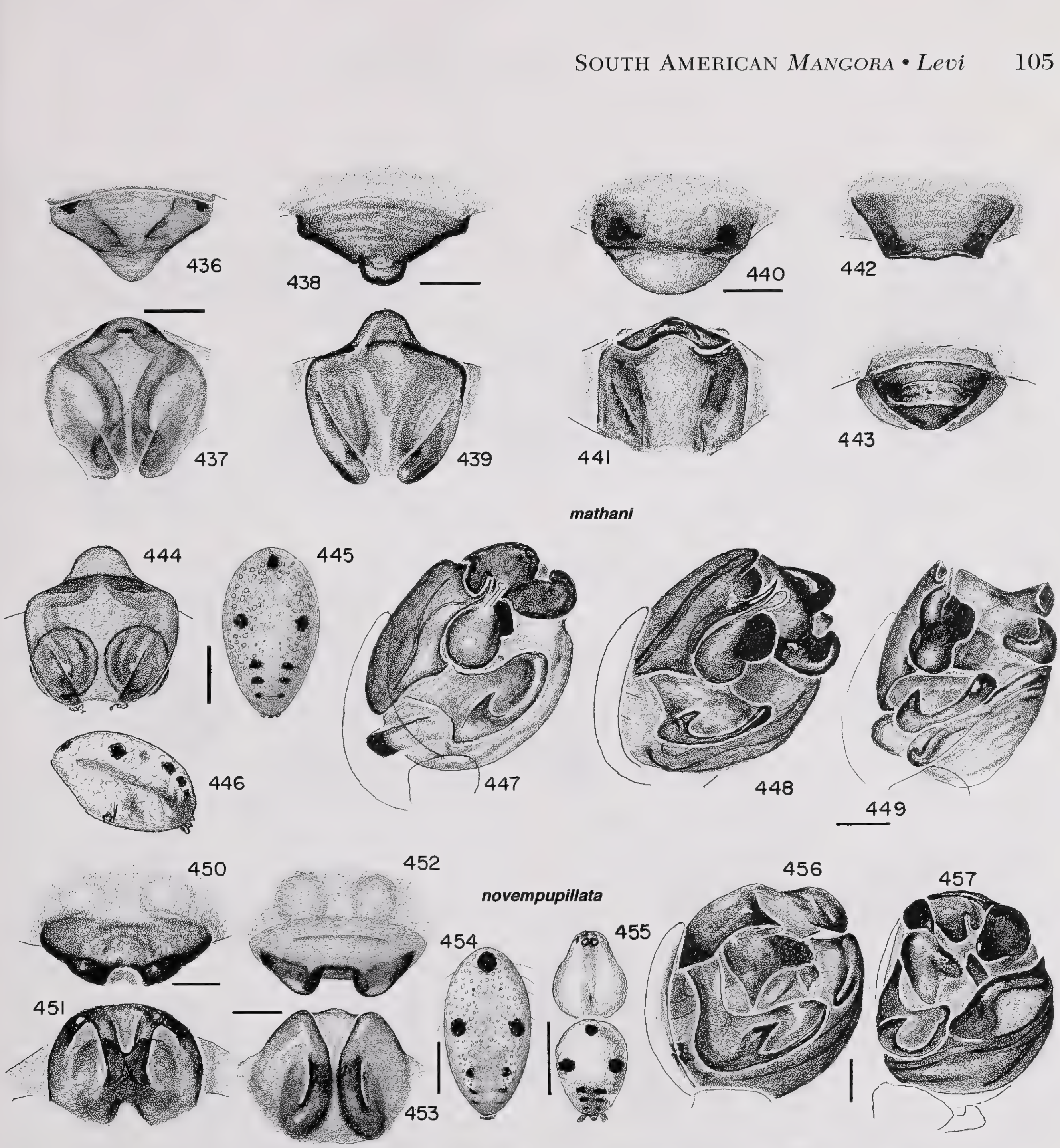
Mangora novempupillata Mello-Leitão
Figures 450–457; Map 4C

Mangora 9-pupillata Mello-Leitão, 1940: 26, figs. 6–8, ♀. Female holotype from Rio Xingu, Pará, Brazil, in MNRJ, examined.
Mangora novempupillata:—Platnick, 2006.

Note. It is not possible to interpret Mello-Leitão's illustration of the epigynum.

The type locality is uncertain. Rio Xingo is formed by the confluence of three rivers in Mato Grosso and, after 2,100 km, joins the Amazon. The stream with its many loops is probably twice this length. Small collections of spiders were apparently presented to Mello-Leitão from a friend's trip on the Rio Xingu.

Description. Female from Peru. Prosoma light yellow, except distal legs darker. Abdomen: whitish; dorsum with white pigment spots and nine gray marks (Fig. 454); venter with two bands of white spots and gray laterally. Posterior eye row procurved. Ocular quadrangle slightly longer than wide, posterior widest. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.4 diameter apart, 0.5 from laterals. Posterior median eyes 0.6 diameter apart, 1.0 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Total length 4.1 mm. Carapace 1.8 mm long, 1.5 wide in thoracic region, 0.8 wide behind



Figures 436–449. *Mangora mathani* Simon. 436–446, female. 436–444, epigynum. 436, 438, 440, 442, ventral; 437, 439, 441, 444, posterior; 443, ventral-posterior. 442, 443, lobe broken off. 444, cleared. 445, abdomen, dorsal. 446, abdomen, lateral. 447–449, left male palpus. 447, submesal; 448, mesal; 449, ventral.

Figures 450–457. *M. novempupillata* Mello-Leitão. 450–454, female. 450–453, epigynum. 450, 452, ventral; 451, 453, posterior. 454, abdomen, dorsal. 455–457, male. 455, carapace, abdomen. 456, 457, male palpus. 456, mesal; 457, ventral.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

lateral eyes, 0.8 high. First femur 1.9 mm, patella and tibia 2.1, metatarsus 1.9, tarsus 0.7. Second patella and tibia 1.8 mm, third 1.3, fourth 2.0.

Male from Reserva Florestal Adolpho Ducke, Manaus. Coloration as in female (Fig. 455). Posterior eye row procurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 0.7 diameter of anterior medians; lateral eyes 0.4 diameter. Anterior median eyes 0.7 diameter apart, 0.4 from laterals. Posterior median eyes 0.4 diameter apart, 1.0 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Total length 2.9 mm. Carapace 1.4 mm long, 1.2 wide in thoracic region, 0.4 wide behind lateral eyes, 0.7 high. First femur 1.5 mm,

patella and tibia 1.6, metatarsus 1.3, tarsus 0.6. Second patella and tibia 1.4 mm, third 0.8. Fourth femur 1.4, patella and tibia 1.7, metatarsus 1.0, tarsus 0.6.

Males and females have been collected together.

Variation. Total length of females 3.3 to 4.1 mm, males 2.7 to 3.0. Figures 450, 451 were made from a specimen from Roraima, Brazil; Figures 452–454 from the holotypes; Figures 455–457 from a male from the Manaus area, Brazil.

Diagnosis. The median notch of the rim (Figs. 450, 452) of the epigynum and, in posterior view, the median curved, sclerotized ridges (Figs. 451, 453) separate *M. novempupillata* from others with black spots on the abdomen.

The conductor of the palpus, unlike that of other species, has a punctate, swollen shield and a triangle pointing at the median apophysis (Fig. 456).

Natural History. Specimens have been collected from rainforest in Roraima.

Distribution. Amazon and upper Amazon regions (Map 4C).

Specimens Examined. COLOMBIA *Meta:* Hacienda Mozambique, l5 km SW Puerto Lopez [prob. 1970s], 1♀ (W. Eberhard, MCZ); Parque Nacional Natural La Macarena, May 2002, 1♂ (ICNB AR-3342). *Putumayo:* Buena Vista, Putumayo River, 23–29 July 1972, 1♀ (W. Eberhard, MCZ); Puerto Asis, 1972, 1♀ (W. Eberhard 450, MCZ). PERU *Loreto:* Explorama Inn, 40 km NE Iquitos, 19, 21 July 1989, 1♀ (G. B. Edwards, FSCA). *Junín:* Amable María, Prov. Tarma, 640 m, on Río Chanchamayo, Peru, ca. 1870s, 1♀ (K. Jelski, PAN). *Madre de Dios:* 15 km E Puerto Maldonado, ca. 12°33′S, 69°03′W, 200 m, 7 Mar. 1990, 1♂ (D. Silva D., MUSM). BRAZIL *Pará:* Belém, Aug. 1953, 1♀ (J. P. Gerschman, MACN); Caxiuanã, Melgaço, 11 Aug. 1996, 1♂ (A. A. Lise, MCP 9377). *Roraima:* São Gabriel da Cachoeira, Rio Uraricoera, Ilha de Maracá, 18–22 Aug. 1987, 2♀ (R. Gribel, MCN 20039); 4–8 Dec. 1987, 1♀ (E. H. Buckup, MCN 27437a); Ilha de Maracá, 31 Jan.–14 Feb. 1992, 2♀, 1♂ (A. A. Lise, MCP 867). *Amazonas:* Manaus, Reserva Florestal Adolpho Ducke, 4 Aug. 1987, 1♂ (J. Vidal, MCN 27438); 18–25 Feb. 1992, 1♀ (A. D. Brescovit, MCN 22075); Manaus, Reserva do km 41, Fazenda Esteio, 13 Jan. 1994, 1♀ (A. D. Brescovit, MCN 25359); near Manaus, km 41 Reserve, 17 Apr. 1991, 1♀ (H. G. Fowler et al., MCZ). *Rondônia:* NE Cacaulândia, Fazenda Rancho Grande, 6–15 Dec. 1990, 1♀ (G. B. Edwards, FSCA). *Acre:* Rio Branco, Reserva Extrativista de Catuaba, 9 Apr. 1996, 2♀ (IBSP, SMNK staff, 15912a). *Mato Grosso:* Vera, 12°46′S, 53°30′W, Oct. 1973, 1♂ (M. Alvarenga, AMNH); Sinop, Oct. 1976, 1♂ (M. Alvarenga, AMNH). BOLIVIA *Beni:* Estacion Biologica Beni, on trail from forest camp to Zone 1, 7, 12 Sep. 1987, 1♀, 1♂ (S. Larcher, USNM).

Mangora insperata Soares and Camargo Figures 458–464; Map 4E

Mangora insperata Soares and Camargo, 1948: 374, figs. 29, 29A, ♀. Female holotype and one paratype from Chavantina, Mato Grosso, Brazil, in MZSP no. 1298, examined. Platnick, 2006.

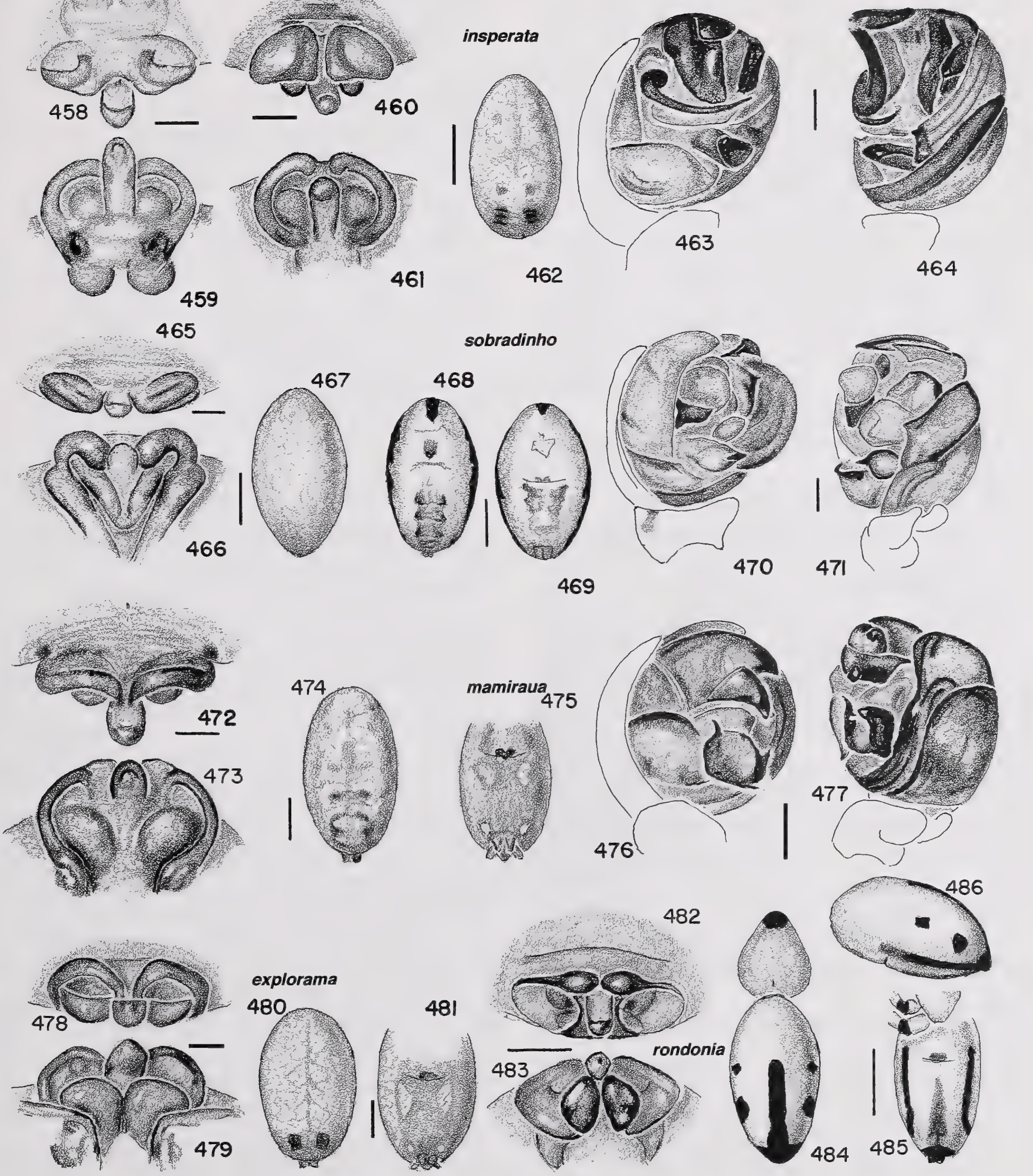
Description. Female holotype. Carapace orange-white. Legs light orange-white. Abdomen: orange-white; dorsum with posterior pairs of dark marks (Fig. 462). Posterior eye row recurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 1.0 diameter of anterior medians; anterior lateral eyes 0.6 diameter, posterior medians 0.5. Anterior median eyes 1.0 diameter apart, 1.2 from laterals. Posterior median eyes 0.4 diameter apart, 1.2 from laterals. The anterior and posterior slopes of the carapace are at an angle of about 85°. Height of clypeus equals 0.9 diameter of anterior median eye. Total length 4.7 mm. Carapace 1.7 mm long, 1.4 wide in thoracic region, 0.7 wide behind lateral eyes, 1.2 high. First femur 1.7 mm, patella and tibia 2.1, metatarsus 1.5, tarsus 0.7. Second patella and tibia 2.0 mm, third 1.5, fourth 2.0.

Male from Roraima. Abdomen: dorsum with white pigment spots, indistinct pos-

→

Figures 458–464. *Mangora insperata* Soares and Camargo. 458–462, female. 458–461, epigynum. 458, 460, ventral; 459, 461, posterior. 462, abdomen, dorsal. 463, 464, left male, palpus, 463, mesal; 464, ventral.

Figures 465–471. *M. sobradinho* new species. 465–469, female. 465, 466, epigynum. 465, ventral; 466, posterior. 467, 468, abdomen, dorsal. 469, abdomen, ventral. 470, 471, male palpus. 470, mesal; 471, ventral.



Figures 472–477. *M. mamiraua* new species. 472–475, female. 472, 473, epigynum. 472, ventral; 473, posterior. 474, abdomen, dorsal. 475, abdomen, ventral. 476, 477, male palpus. 476, mesal; 477, ventral.

Figures 478–481. *M. explorama* new species, female. 478, 479, epigynum. 478, ventral; 479, posterior. 480, abdomen, dorsal. 481, abdomen, ventral.

Figures 482–486. *M. rondonia* new species, female. 482, 483, epigynum. 482, ventral; 483, posterior. 484, carapace, abdomen. 485, sternum, abdomen. 486, abdomen, lateral.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

terior patches of transverse colorless marks. Posterior eye row procurved. Ocular quadrangle wider than anterior width, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.4 diameter. Anterior median eyes 0.5 diameter apart, 0.5 from laterals. Posterior median eyes 0.4 diameter apart, 1.2 from laterals. Height of clypeus equals 1.2 diameters of anterior median eyes. Fourth femur with a proximal, ventral macroseta. Total length 3.2 mm. Carapace 1.6 mm long, 1.3 wide in thoracic region, 0.5 wide behind lateral eyes, 0.9 high. First femur 1.6 mm, patella and tibia 1.8, metatarsus 1.3, tarsus 0.7. Second patella and tibia 1.6 mm, third 1.4, fourth 1.6.

Males and females have been collected together.

Variation. Total length of females 4.7 to 5.5 mm. Figures 458, 459 were made from the holotype; Figures 460, 461 from a female from Mato Grosso; Figures 462–464 from specimens from Roraima.

Diagnosis. Mangora insperata (Fig. 462) differs from *M. sobradinho* (Figs. 467–469) in coloration. Also, the *M. insperata* epigynum is lightly sclerotized and in ventral view is distinguished from that of *M. sobradinho* (Figs. 465, 466) by the visible ducts, which turn anteromedially (Figs. 458, 460) and, in posterior view, by the rounded frame encircling a spherical structure (Figs. 459, 461).

Unlike other Mangora species, the male palpus has a transverse saber-like embolus (Fig. 463).

Natural History. Specimens were collected in forest canopy in Vaupés, Colombia, and in gallery forest of Mato Grosso by the Xavantina-Cochimbo Expedition.

Distribution. Upper Amazon from Colombia to Mato Grosso, Brazil (Map 4E).

Specimens Examined. COLOMBIA *Vaupés:* Bajo Río Apaporis, Lago Taraira, Estacíon Biológica Caparú, 200 m, Sep. 2002–May 2003, 1♀ (L. Benavides, ICNB AR-2989). PERU *Madre de Dios:* Manu, Pakitza, 11°56′S, 71°18′W, Trail 1, marker 14, stream, 10–23 Sep. 1989, 1♀ (N. Adams et al., USNM). BRAZIL *Roraima:* São Gabriel da Cachoeira, Rio Uraricoera, Ilha de Maracá, 31 Jan.–14 Feb. 1992, 1♀ (A. B. Bonaldo, MCP 1866); Ilha de Maracá, 25 July 1987, 2♀, 1 imm. (A. A. Lise, MCN 27429); 21–30 Nov. 1987, 1♀, 1♂ (J. A. Rafael, MCN 27440). *Amazonas:* Tefé, Fonte Boa, São Paulo de Olivença, ca. 1880s, 1♀ (M. de Mathan, MNHN). *Mato Grosso:* Santo Antônio de Leverger, 29 July 1992, 2♀ (A. A. Lise, A. Braul, MCP 2396b); 260 km N of Xavantina [Chavantina], 12°49′S, 51°46′W, 400 m, Feb–Apr. 1969, 1♀ (Xavantina-Cachimbo Exped., MCZ).

Mangora sobradinho new species
Figures 465–471; Map 4I

Holotype. Female holotype, one male and three female paratypes from Sobradinho, Rio Grande do Sul, Brazil, 10 Jan. 1985 (A. A. Lise), in MCN 12887. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma orange-yellow, abdomen white without marks (Fig. 467). Posterior eye row procurved. Ocular quadrangle wider than long, posterior widest. Posterior median eyes 1.5 diameters of anterior medians; lateral eyes 0.9 diameter. Anterior median eyes 1.3 diameters apart, 1.8 from laterals. Posterior median eyes 1.5 diameters apart, 1.0 from laterals. Height of clypeus equals 0.5 diameter of anterior median eyes. Total length 4.7 mm. Carapace 2.0 mm long, 1.6 wide in thoracic region, 0.8 wide behind lateral eyes, 1.1 high. First femur 2.6 mm, patella and tibia 2.8, metatarsus 2.4, tarsus 1.0. Second patella and tibia 2.7 mm, third 1.7. Fourth femur 2.8 mm, patella and tibia 2.8, metatarsus 2.3, tarsus 0.8.

Male paratype. Prosoma orange-yellow; abdomen white with indistinct paired black, transverse streaks on posterior end of dorsum. Posterior eye row recurved. Ocular quadrangle wider than long, posterior widest. Posterior median eyes 1.8 diameters of anterior medians; lateral eyes 0.9 diameter. Anterior median eyes 1.1 diameters apart, 1.5 from laterals. Posterior median eyes 1.0 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Fourth femur with four ventral macrosetae. Total length 3.8 mm. Carapace 1.9 mm long, 1.7 wide in thoracic region, 0.8 wide behind lateral eyes, 0.6 high. First femur 2.4 mm,

patella and tibia 2.7, metatarsus 2.3, tarsus 1.0. Second patella and tibia 2.3 mm, third 1.4, fourth 2.5.

Males and females have been collected together.

Variation. Total length of females 3.7 to 5.3 mm, males 3.4 to 3.8. Some specimens (Figs. 468, 469 from São Paulo) were darker colored than the holotype (Fig. 467).

Diagnosis. As in *M. mamiraua* (Figs. 472, 473), the epigynum of *M. sobradinho* differs from that of *M. insperata* (Figs. 458, 460) by having the transverse ducts (Fig. 472), visible in ventral view, turning laterally into an anterior transverse position (Fig. 465), and from both species by the heart-shaped outline of the swollen lateral plates in posterior view (Fig. 466).

The palpus differs from those of related species by the triangular embolus (center in Fig. 470).

Distribution. Southern Brazil, from São Paulo to Rio Grande do Sul (Map 4I).

Specimens Examined. BRAZIL *São Paulo:* São Paulo, Bosque da Saude, 22 Mar. 1942, 2♀ (F. Lane, MZSP 10775); Monte Alegre, 20 Feb. 1943, 1♀ (J. L. Lima, MZSP 4657); Botucatu Rubião Junior, Fazenda Butignoli, 7 Jan. 1987, 1♂ (I. M. P. Rinaldi, L. C. Forti, UBTU). *Paraná:* Três Barras do Paraná, Giacomet-Marundím, 27 Feb. 1993, 1♀ (A. B. Bonaldo, MCN 23049); Capitão Leonidas Marques, Represa de Salto Caxias, Rio Iguaçú, 20–28 Mar. 1993, 1♀ (A. B. Bonaldo, MCN 23304). *Santa Catarina:* Chapecó, 23 Mar. 2001, 1♂ (P. Pergher, MCP 11393). *Rio Grande do Sul:* São Francisco de Paulo, Barragem dos Bugres, 1–4 Feb. 1999, 3♀ (A. B. Bonaldo, MCN 30370); Canela, 20 Mar. 1976, 1♀ (A. A. Lise, MCN 4070); Candelária, Cerro de Botucaraí, 5–9 Feb. 2001, 1♀ (A. Franceschini, MCN 33617); Machadinho, 8–14 Feb. 1989, 1♂ (A. B. Bonaldo, MCN 18190); Rio Apuae [?], Feb. 1989, 1♂ (Itá-Machado, MCP 6459); Espumoso, Salto do Jaru, 14 Jan. 1982, 1♀ (A. A. Lise, MCN 9985); Viamão, 15 Dec. 1995, 1♀ (A. A. Lise et al., MCP 9023).

Mangora mamiraua new species
Figures 472–477; Map 5C

Holotype. Female holotype and male paratype from Estação Ecológica do Mamirauá, Tefé, Amazonas, Brazil, 9–13 Oct. 1992 (S. M. Borgas), in MCN 22878. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma orange, sternum darkest. Abdomen: whitish, dorsum with white spots and posterior black marks (Fig. 474); venter with pair of white pigment spots and a pair of distinct white spots anterior to spinnerets (Fig. 475). Posterior eye row recurved. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 1.0 diameter apart, 1.0 from laterals. Posterior median eyes 0.4 diameter apart, 1.4 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 5.2 mm. Carapace 2.2 mm long, 1.7 wide in thoracic region, 0.7 wide behind lateral eyes, 1.2 high. First femur 2.8 mm, patella and tibia 2.5, metatarsus 1.7, tarsus 0.8. Second patella and tibia 2.4 mm, third 1.6. Fourth femur 2.3 mm, patella and tibia 2.6, metatarsus 2.1, tarsus 0.8.

Male paratype. Prosoma yellow, eye region gray, and carapace with median gray line. Abdomen: white, dorsum with gray cardiac mark and a transverse line posteriorly; venter with epigastric area and spinnerets gray. Posterior eye row procurved. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.8 diameter apart, 0.4 from laterals. Posterior median eyes 0.5 diameter apart, 1.0 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Total length 2.0 mm. Carapace 1.1 mm long, 0.8 wide in thoracic region, 0.4 wide behind lateral eyes, 0.6 high. First femur 1.2 mm, patella and tibia 1.2, metatarsus 0.8, tarsus 0.4. Second patella and tibia 1.1 mm, third 0.8, fourth 1.1.

Although collected with females, there is doubt whether male and female belong together. The male is smaller than might be expected, and the markings on the abdomen are slightly different from those of the female.

Variation. Total length of males 1.8 to 3.1 mm. The distal end of the median apophysis has two points, which were add-

ed to the illustration; the paratype seems to have a truncate end. Perhaps it is broken.

Diagnosis. The epigynum *M. mamiraua* (Figs. 472, 473) differs from that of *M. insperata* (Fig. 458), in that the ducts visible in ventral view turn anterolaterally and in the median posteriorly (Fig. 472), and from that of *M. sobradinho* in posterior view by having the median plate oval and the swollen, curved lateral plates encircling semispherical bodies (Fig. 473).

The oval median apophysis of the palpus with three small spines (5 h in Fig. 476) and the bent embolus and lobe above it separates the male from others (Fig. 476).

Distribution. Amazon region (Map 5C).

Specimens Examined. BRAZIL *Amazonas:* Manaus, Lago do José, 9 Aug. 1979, 1♂ (J. Adis, MCN 27442); Manaus, Paraná do Xiboreninho, 7 Aug. 1979, 1♂ (J. Adis et al., IBSP 17124).

Mangora explorama new species
Figures 478–481; Map 5E

Holotype. Female holotype from Explorama Lodge, 80 km NE Iquitos, 100 m, Loreto, Peru, 16–20 July 1989 (G. B. Edwards), in FSCA. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma orange-yellow. Abdomen: dorsum spotted white with a pair of posterior black rectangles (Fig. 480); venter with a pair of white marks and a pair of white spots anterolateral to spinnerets (Fig. 481). Posterior eye row slightly recurved. Ocular quadrangle slightly wider anterior than long, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 0.5 diameter apart, 1.0 from laterals. Posterior median eyes 0.3 diameter apart, 1.5 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 6.5 mm. Carapace 2.2 mm long, 1.7 wide in thoracic region, 0.7 wide behind lateral eyes, 1.2 high. First femur 2.4 mm, patella and tibia 2.5, metatarsus 1.9, tarsus 0.8. Second patella and tibia 2.4 mm, third 2.3. Fourth femur 2.5 mm, patella and tibia 2.7, metatarsus 2.3, tarsus 0.7.

The male is not known.

Diagnosis. In ventral view, the epigynum (Figs. 478, 479) differs from that of *M. sobradinho* (Fig. 465) and *M. mamiraua* (Fig. 472) by the swollen arches and small cup-like structure on each side of the short scape (Fig. 478) and, in posterior view, two sclerotized circles (Fig. 479).

Distribution. Upper Amazon: northern Peru (Map 5E).

Specimens Examined. No other specimens have been found.

Mangora rondonia new species
Figures 482–486; Map 5C

Holotype. Female holotype from Porto Velho, Rondônia, Brazil, 15 Apr. 1996 (IBSP, SMNK staff), in IBSP 16162. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma orange-yellow, eye region black (Fig. 484), some coxae with distal black ring, trochanters black (Fig. 485), legs with distal half of femora black and distal leg articles dark orange-yellow. Abdomen: with contrasting, discrete black marks on yellowish white (Figs. 484–486). Posterior eye row procurved. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 1.1 diameters apart, 0.7 from laterals. Posterior median eyes 1.0 diameter apart, 1.0 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Total length 3.3 mm. Carapace 1.2 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.8 high. First femur 1.3 mm, patella and tibia 1.6, metatarsus 1.3, tarsus 0.7. Second patella and tibia 1.4 mm, third 0.8, fourth 1.6.

The male is not known.

Diagnosis. Mangora rondonia is distinguished from other species by the contrasting coloration of the abdomen (Figs. 484–486) and by the unique epigynum, which in ventral view has oval structures anterior to the short scape (Fig. 482) and

in posterior view has irregularly shaped structures sitting on the surface of the median plate dorsal of the scape (Fig. 483).

Distribution. Upper Amazon: southwestern Brazil (Map 5C).

Specimens Examined. No other specimens have been found.

Mangora bemberg new species
Figures 487–490; Map 5F

Holotype. Female holotype from Río Uruqua-í, Puerto Bemberg [Puerto Libertad], Pasarela, Misiones, Argentina, 1 Feb. 1950 (A. Giai, W. Partridge), in MACN no. 3140. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellowish. Abdomen: dorsum with some white pigment spots and a posterior pair of black patches (as in Fig. 494); venter with some white pigment spots [the abdomen of the holotype is in poor condition]. Posterior eye row slightly recurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.4 diameter apart, 2.0 from laterals. Posterior median eyes 0.2 diameter apart, 2.2 from laterals. Height of clypeus equals 1.3 diameters of anterior median eyes. Total length ca. 5.2 mm. Carapace 2.6 mm long, 2.0 wide in thoracic region, 0.9 wide behind lateral eyes, 1.6 high. First femur 2.6 mm, patella and tibia 2.9, metatarsus 2.7, tarsus 1.0. Second patella and tibia 2.8 mm, third 1.9. Fourth femur 2.8 mm, patella and tibia 3.3, metatarsus 2.8, tarsus 1.0.

Male paratype. Prosoma yellow. Abdomen: lighter than in female; dorsum with two posterior black patches. Posterior eye row slightly recurved. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.7 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.6 diameter apart, 1.2 from laterals. Posterior median eyes 0.4 diameter apart, 2.0 from laterals. Height of clypeus equals 1.2 diameters of anterior median eyes. First femur with a ventral, proximal macroseta. Total length 5.3 mm. Carapace 2.4 mm long, 2.0 wide in thoracic region, 0.8 wide behind lateral eyes, 1.1 high. First femur 2.8 mm, patella and tibia 3.2, metatarsus 2.7, tarsus 1.1. Second patella and tibia 2.8 mm, third 1.8, fourth 3.1.

Males and females were collected together, but were in separate vials.

Variation. Total length of females 5.2 to 6.8 mm, males 4.4 to 5.3. The fourth femur of a male from Minas Gerais had a ventral row of about six macrosetae.

Diagnosis. The female epigynum has a tongue (Fig. 487), which in posterior view is distinguished by a constriction (Fig. 488).

The palpus of the male *M. bemberg* has a unique projecting terminal apophysis (1 h in Figs. 489, 490) and a small median apophysis with a spine facing distally, partly hidden by the radix (6 h in Fig. 489).

Distribution. Paraná State, southern Brazil, to northeastern Argentina (Map 5F).

Paratypes. ARGENTINA *Misiones:* Puerto Bemberg [Puerto Libertad], Pasarela Río Urugua-í, 1 Feb. 1950, 1♀, 3♂ (A. Giai, W. Partridge, MACN 3141, 3142).

Specimens Examined. BRAZIL *Minas Gerais:* Lavras, 29 Mar. 1979, 1♂ (W. D. Fronk, MCZ). *Paraná:* General Carneiro, 23 Apr. 1993, 1♀ (R. Bóçon, MCN 23597); Cavinna [?], 1947, 1♀ (A. Maller, AMNH).

Mangora eberhardi new species
Figures 491–496; Map 5B

Holotype. Male holotype and female paratype from near Yotoco, 1,600 m elev., Valle, Colombia, Dec. 1976 (W. Eberhard), in MCZ. The species is named after the collector, arachnologist W. Eberhard.

Description. Female paratype. Prosoma light yellow with small black circles around posterior median eyes. Abdomen: whitish; dorsum with two posterior black patches and several paired white pigment streaks (Fig. 494). Posterior eye row recurved. Ocular quadrangle slightly longer than wide, anterior slightly widest. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.8 diameter. Anterior

median eyes 1.0 diameter apart, 1.0 diameter from laterals. Posterior median eyes 0.3 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 3.6 mm. Carapace 1.3 mm long, 0.9 wide in thoracic region, 0.5 wide behind lateral eyes, 0.9 high. First femur 1.5 mm, patella and tibia 1.6, metatarsus 1.2, tarsus 0.7. Second patella and tibia 1.4 mm, third 0.8, fourth 1.4.

Male holotype. Coloration as in female. Posterior eye row recurved. Ocular quadrangle almost square, anterior slightly widest. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 0.8 diameter apart, 0.5 diameter from laterals. Posterior median eyes 0.4 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 2.7 mm. Carapace 1.2 mm long, 1.1 wide in thoracic region, 0.4 wide behind lateral eyes, 0.7 high. First femur 1.4 mm, patella and tibia 1.7, metatarsus 1.0, tarsus 0.6. Second patella and tibia 1.4 mm, third 0.8, fourth 1.2.

Males and females have been collected together.

Variation. Total length of females 3.6 to 4.2 mm, males 2.4 to 2.6. The scape of the female paratype, collected with the male holotype, is broken off.

Diagnosis. Unlike other species with paired black patches on the posterior of the abdomen, the female of *M. eberhardi* has a projecting epigynum with a long lobed scape (Fig. 491), and the posterior side has a Y-shaped median plate (Fig. 492).

The male palpus differs from others by an indistinct pointed lobe (10 h in Fig. 495) and, in ventral view, by a bent truncate prong, part of the terminal apophysis (Fig. 496).

Distribution. Southwestern Colombia (Map 5B).

Paratypes. COLOMBIA *Valle:* Yotoco, 1,600 m, Dec. 1976, 2♀, 9♂ (W. Eberhard, MCZ); Aug. 1977, 1♀ (W. Eberhard, MCZ).

Specimens Examined. COLOMBIA *Valle:* Cali, 1,000 m, 1976, 1♀ (W. Eberhard, MCZ); nr. Pichinde, 1,700 m, 17 Sep. 1972, 1♀ (W. Eberhard, MCZ); El Silencio, NE Pichinde, 1,700 m, Aug. 1975, 2♀ (W. Eberhard, MCZ); nr. Saladito, 1,700 m, Mar. 1976, 1♀ (W. Eberhard 1061, MCZ); 1,800 m, 1♀ (W. Eberhard 969, MCZ).

Mangora kochalkai new species
Figures 497–499; Map 5B

Holotype. Female holotype from Río Donachui, Sogromen, 1,800 m, Sierra Madre de Santa Marta, Magdalena, Colombia, 1 Jan. 1974 (J. A. Kochalka), in MCZ. The species is named after the collector.

Description. Female holotype. Prosoma light yellowish, small black circles around secondary eyes. Abdomen: light yellowish; dorsum with a pair of posterior black patches and a pair of gray patches anterior to black patches (Fig. 499). Posterior eye row slightly recurved. Ocular quadrangle longer than wide, rectangular. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 1.0 diameter apart, 1.8 from laterals. Posterior median eyes 0.4 diameter apart, 1.2 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 4.3 mm. Carapace 1.4 mm long, 1.3 wide in thoracic region, 0.6 wide behind lateral eyes, 0.8 high. First femur 1.7 mm, patella and tibia 1.9, metatarsus 1.5, tarsus 0.7. Second patella and tibia 1.7 mm, third 1.2, fourth 1.8.

The male is not known.

Diagnosis. Unlike the *M. vianai* epigynum (Fig. 500) that of *M. kochalkai* is an

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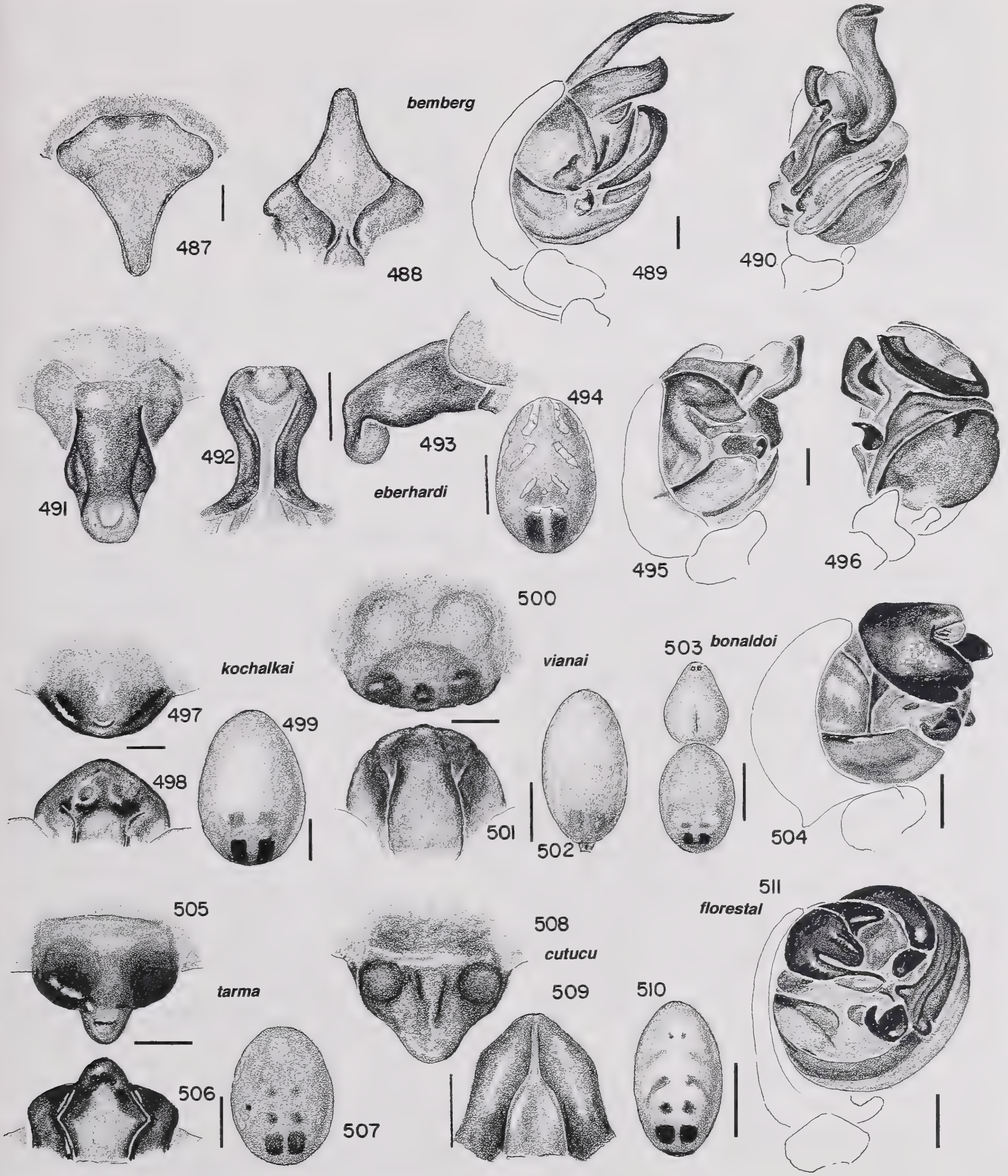
Figures 487–490. *Mangora bemberg* new species. 487, 488, female, epigynum. 487, ventral; 488, posterior. 489, 490, left male, palpus. 489, mesal; 490, ventral.

Figures 491–496. *M. eberhardi* new species. 491–494, female. 491–493, epigynum. 491, ventral; 492, posterior; 493, lateral. 494, abdomen, dorsal. 495, 496, male palpus. 495, mesal; 496, ventral.



Figures 497–499. *M. kochalkai* new species, female. 497, 498, epigynum. 497, ventral; 498, posterior. 499, abdomen, dorsal.

Figures 500–502. *M. vianai* new species, female. 500, 501, epigynum. 500, ventral; 501, posterior. 502, abdomen, dorsal.

Figures 503, 504. *M. bonaldoi* new species, male. 503, carapace, abdomen. 504, palpus, mesal.

Figures 505–507. *M. tarma* new species, female. 505, 506, epigynum. 505, ventral; 506, posterior. 507, abdomen, dorsal.

Figures 508–510. *M. cutucu* new species, female. 508, 509, epigynum. 508, ventral; 509, posterior. 510, abdomen, dorsal.

Figure 511. *M. florestal* new species, male palpus, mesal.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

evenly curved lobe (Fig. 497). In posterior view the median posterior plate has a narrow neck ventrally, forming a septum between two depressions (Fig. 498).

Distribution. Northern Colombia (Map 5B).

Specimens Examined. COLOMBIA *Magdalena:* Valley NE of Cerro Yosagaca, 1,680 m, Sierra Madre de Santa Marta, 30 Dec. 1973, 1♀ (J. A. Kochalka, MCZ).

Mangora vianai new species
Figures 500–502; Map 5F

Holotype. Female holotype from Santa María, Misiones, Argentina, Nov.–Dec. 1952 (M. J. Viana), in MACN no. 3594a. The species is named after the collector.

Description. Female holotype. Prosoma yellowish. Abdomen: whitish; dorsum posterior darker gray with a pair of indistinct gray patches (Fig. 502). Posterior eye row straight. Ocular quadrangle slightly wider than anterior width, anterior widest. Posterior median eyes 1.1 diameters of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 1.0 diameter apart, 1.0 from laterals. Posterior median eyes 0.5 diameter apart, 1.2 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 4.2 mm. Carapace 1.5 mm long, 1.1 wide in thoracic region, 0.5 wide behind lateral eyes, 1.2 high. First femur 1.3 mm, patella and tibia 1.3, metatarsus 1.2, tarsus 0.5. Second patella and tibia [lost], third 1.1 mm. Fourth femur 1.3 mm, patella and tibia 1.5, metatarsus 1.2, tarsus [0.6 from similarly sized paratype].

The male is unknown.

Variation. Total length of females 3.6 to 4.2 mm. The edge of the epigynum is covered by hardened mucus.

Diagnosis. Mangora vianai epigynum has an almost straight rim with a median dark mark (Fig. 500). It differs from that of *M. kochalkai* in having a wide posterior median plate between a pair of depressions (Fig. 501).

Distribution. Northeastern Argentina (Map 5F).

Paratypes. ARGENTINA *Misiones:* Santa María, Nov.–Dec. 1952, 2♀ (M J. Viana, MACN 3594).

Mangora bonaldoi new species
Figures 503, 504; Map 5F

Holotype. Male holotype from Usina Hidroelétrica Serra do Mesa, Minaçú, Goiás, 13°45′S, 47°50′W, Brazil, 1–10 Nov. 1956 (A. Bonaldo and L. Moura), in MCN 27831. The species is named after the collector, arachnologist A. Bonaldo.

Description. Male holotype. Specimen yellowish, except for black eye rings and dorsum and sides of abdomen. Abdomen: dorsum patches with white pigment spots, a posterior pair of black patches, and a pair of small gray marks anterior to black patches (Fig. 503); sides with white pigment spots. Posterior eye row slightly procurved. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.4 diameter. Anterior median eyes 0.6 diameter apart, 0.5 from laterals. Posterior median eyes 1.0 diameter apart, 1.5 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Fourth femur with a proximal, ventral macroseta. Total length 3.2 mm. Carapace 1.4 mm long, 1.3 wide in thoracic region, 0.6 wide behind lateral eyes, 0.7 high. First femur 1.7 mm, patella and tibia 1.8, metatarsus 1.4, tarsus 0.7. Second patella and tibia 1.7 mm, third 0.8, fourth 1.5.

The female is unknown.

Diagnosis. The *M. bonaldoi* palpus is recognized by the heavily sclerotized bilobed sclerite of the terminal apophysis (12–3 h in Fig. 504).

Distribution. Only known from southeastern Brazil (Map 5F).

Specimens Examined. No other specimens were found.

Mangora tarma new species
Figures 505–507; Map 5C

Holotype. Female holotype and eight female paratypes from Amable María [Dept. Junín, Prov. Tarma, 640 m, on Río Chanchamayo], Peru, ca. 1870s, in PAN. The specific name is a noun in apposition after the type locality.

Description. Female paratype. Prosoma yellow, distal articles of legs darker. Abdomen: light yellow; dorsum with anterior patches of white pigment spots, with three pairs of posterior gray spots (Fig. 507). Posterior eye row procurved. Ocular quadrangle as long as posterior width, posterior widest. Posterior median eyes 1.3 diameters of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.6 diameter apart, 0.7 from laterals. Posterior median eyes 0.6 diameter apart, 1.2 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 3.2 mm. Carapace 1.5 mm long, 1.2 wide in thoracic region, 0.6 wide behind lateral eyes, 0.6 high. First femur 1.5 mm, patella and tibia 1.5, metatarsus 1.3, tarsus 0.6. Second patella and tibia 1.3 mm, third 1.0. Fourth femur 1.4 mm, patella and tibia 1.5, metatarsus 1.1, tarsus 0.6.

The male is not known.

Variation. Total length of females 3.0 to 3.2 mm.

Diagnosis. The *M. tarma* epigynum is heavily sclerotized. In posterior view, the species is distinguished by the diamond shape of its median plate (Fig. 506), but the seams between plates are difficult to see.

Distribution. Central Peru (Map 5C).

Specimens Examined. PERU *Junín:* Utcuyacu, 1,600–2,000 m, Feb. 1948, 1♀ (F. Woytkowsky, AMNH).

Mangora cutucu new species
Figures 508–510; Map 5C

Holotype. Female holotype and three female paratypes from main trail Logroño to Yaupi, 1,700–2,100 m, 02°38′S, 78°30′W, W slope of Cordillera del Cutucu, Morona-Santiago, Ecuador, 1 July 1984 (R. M. Peck), in ANSP. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma dark yellow, sternum darker. Abdomen: dorsum yellow, with posterior black patches and anterior gray marks (Fig. 510). Posterior eye row recurved. Ocular quadrangle square. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 0.8 diameter apart, 0.8 from laterals. Posterior median eyes 0.8 diameter apart, 1.5 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 2.7 mm. Carapace 1.4 mm long, 1.1 wide in thoracic region, 0.6 wide behind lateral eyes, 0.8 high. First femur 1.5 mm, patella and tibia 1.5, metatarsus 1.1, tarsus 0.5. Second patella and tibia 1.4 mm, third 0.8, fourth 1.4.

The male is not known.

Variation. Total length of females 2.7 to 3.1 mm. One female had the dorsum of the abdomen with patches of white pigment spots.

Diagnosis. Unlike the epigynum of *M. tarma* (Fig. 506), that of *M. cutucu* has a median posterior plate with a narrow ventral projection (Fig. 509).

Natural History. The holotype and paratypes were found in tall, humid forest on a flat ridge top in a remote, large pristine area.

Distribution. Known only from southeastern Ecuador (Map 5C).

Specimens Examined. No other specimens were found.

Mangora florestal new species
Figure 511; Map 5F

Holotype. Male holotype from Horto Florestal, São Paulo, Est. São Paulo, Brazil, 13 Sep. 2001 (H. F. Japyassú), in IBSP no. 27664. The specific name is a noun in apposition after the type locality.

Description. Male holotype. Prosoma yellowish. Abdomen: dorsum with two posterior black patches and some anterior indistinct white and gray marks. Posterior eye row procurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 0.9 diameter apart, 1.0 from laterals. Posterior median eyes 1.0 diameter apart, 1.1 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Fourth femur with proximal, ventral macroseta [only on left leg]. Total length 2.2 mm. Carapace 1.2 mm long, 1.1

wide in thoracic region, 0.3 wide behind lateral eyes, 1.3 high. First femur 1.1 mm, patella and tibia 1.2, metatarsus 1.0, tarsus 0.5. Second patella and tibia 1.2 mm, third 0.8, fourth femur 1.2.

The female is not known.

Diagnosis. As in *M. missa* (Fig. 163), the *M. florestal* palpus has a filamentous embolus, with a distal lobe above the filament (11 h in Fig. 511). Also as in *M. missa* (Fig. 163), the median apophysis has a hook on the side toward the cymbium (5 h in Fig. 511). However, details of sculpturing of the terminal apophysis differ.

Distribution. Only known from São Paulo, southeastern Brazil (Map 5F).

Specimens Examined. No other specimens have been found.

Mangora oxapampa new species
Figures 512–515; Map 5G

Holotype. Female holotype from 1.3 km south of Mina Pichita, 2,100 m, Junín, Peru, night collecting, 23 Aug. 1980 (B. Alvarado), in MUSM. The specific name is a noun in apposition after the collecting site of a specimen.

Description. Female holotype. Prosoma yellow; median eye region gray, carapace with short median posterior streak. Abdomen: dorsum with a pair of posterior black patches, two pairs of dark gray patches anterior black; white patches of pigment spots anteriorly (Fig. 515); venter whitish; sides with white pigment spots. Posterior eye row straight. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.9 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 1.2 diameters apart, 0.8 from laterals. Posterior median eyes 0.9 diameter apart, 1.2 from laterals. Height of clypeus equals 0.9 diameter of anterior median eyes. Total length 3.7 mm. Carapace 1.5 mm long, 1.2 wide in thoracic region, 0.6 wide behind lateral eyes, 0.8 high. First femur 1.6 mm, patella and tibia 1.7, metatarsus 1.4, tarsus 0.7. Second patella and tibia 1.5 mm, third 1.1, fourth 1.7.

The male is not known.

Variation. Total length of females 3.7 to 4.1 mm. The illustrations were made from the female holotype.

Diagnosis. The *M. oxapampa* epigynum is similar to that of *M. bovis* (Figs. 410, 411) but has a longer, bent scape (Figs. 512, 514) with a recessed posterior median plate (Fig. 513).

Distribution. Upper Amazon: Central Peru (Map 5G).

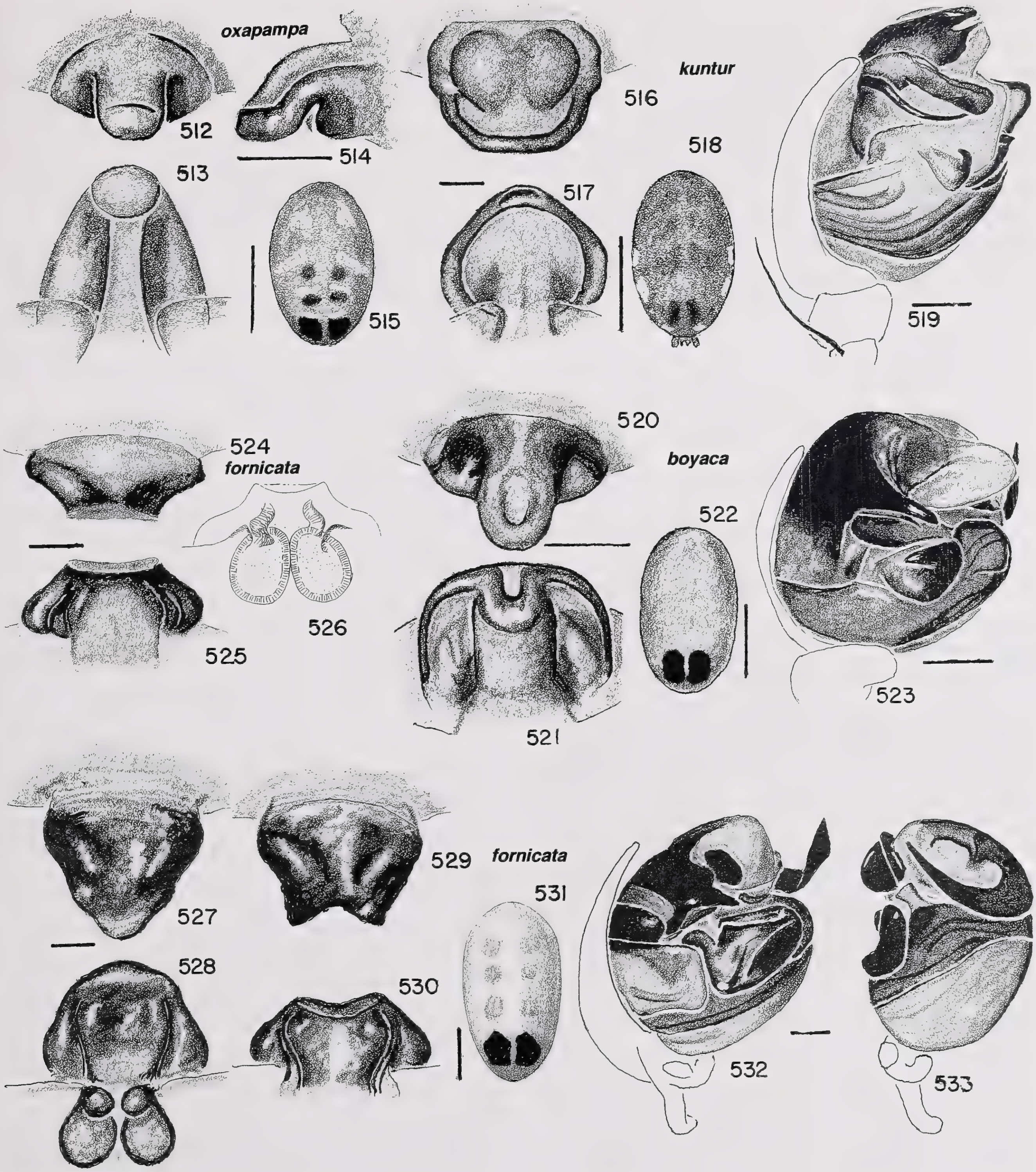
Specimens Examined. PERU *Pasco:* 15 km SE Oxapampa, ca. 1,800 m, 20 June 1986, 1♀ (D. Silva D., MUSM).

Mangora kuntur new species
Figures 516–519; Map 5G

Holotype. Female holotype, 10 female and three male paratypes, from Puesto de Vigilancia 22, Alto Río Comaina, Cordillera del Cóndor, 850–1,150 m, Amazonas, Peru (D. Silva D.), in MUSM. The specific name is a noun in apposition after the type locality. The collector suggested the name. Kuntur is the Quechua word for condor.

Description. Female paratype. Prosoma orange-yellow, labium, endites dark gray, sternum black, legs gray. Abdomen: dorsum dark gray, two posterior darker gray patches with area around patches lighter (Fig. 518); venter lighter gray; sides with two or three light areas containing white pigment spots (Fig. 518). Carapace very high, sternum convex. Posterior eye row straight. Ocular quadrangle longer than wide, rectangular. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 1.0 diameter apart, 0.8 from laterals. Posterior median eyes 0.7 diameter apart, 1.2 from laterals. Height of clypeus equals 1.4 diameters of anterior median eyes. Total length 2.7 mm. Carapace 1.0 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.8 high. First femur 1.2 mm, patella and tibia 1.2, metatarsus 0.8, tarsus 0.7. Second patella and tibia 1.2 mm, third 0.8, fourth 0.7.

Male paratype. Coloration as in female. Posterior eye row straight. Ocular quadrangle longer than wide, rectangular. Posterior median eyes 1.1 diameters of anterior medians; lateral eyes 0.7 diameter. An-



Figures 512–515. *Mangora oxapampa* new species, female. 512–514, epigynum. 512, ventral; 513, posterior; 514, lateral. 515, abdomen, dorsal.

Figures 516–519. *M. kuntur* new species. 516–518, female. 516, 517, epigynum. 516, ventral; 517, posterior. 518, abdomen dorsal. 519, left male palpus, mesal.

Figures 520–523. *M. boyaca* new species. 520–522, female. 520, 521, epigynum. 520, ventral; 521, posterior. 522, abdomen, dorsal. 523, male palpus, mesal.

Figures 524–533. *M. fornicate* (Keyserling). 524–531, female, 524–530, epigynum. 524, 527, 529, ventral; 525, 526, 528, 530, posterior. 524–526, syntype. 526, cleared. 524–526, 529, 530, lobe broken off. 531, abdomen, dorsal. 532, 533, male palpus. 532, mesal; 533, ventral.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

terior median eyes 1.0 diameter apart, 0.6 from laterals. Posterior median eyes 0.9 diameter apart, 1.2 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Carapace very high, sternum convex. No coxal hook. Total length 1.8 mm. Carapace 0.7 mm long, 0.7 wide in thoracic region, 0.3 wide behind lateral eyes, 0.8 high. First femur 1.0 mm, patella and tibia 1.2, metatarsus 0.7, tarsus 0.4. Second patella and tibia 1.1 mm, third 0.7, fourth 0.9.

Males and females were collected together.

Diagnosis. Mangora kuntur and *M. semiatra* differ from most South American *Mangora* by their coloration: a black abdomen with light patches on sides (Fig. 518). The epigynum of *M. kuntur* differs from all others, except *M. leverger*, (Fig. 15) by a transverse depression with a thick rim (Fig. 516) and from *M. leverger* by the oval posterior median plate (Figs. 517).

The male palpus differs from that of *M. insperata* (Fig. 463) by having a slightly curved thin embolus and median apophysis with one distal, pointed hook (4 h in Fig. 519).

Natural History. The specimens came from primary rain forest.

Distribution. Only known from northern Peru (Map 5G).

Specimens Examined. No other specimens have been collected.

Mangora boyaca new species
Figures 520–523; Map 5G

Holotype. Female holotype and three male and two immature paratypes from Santa María, Vereda Caño La Rapida, Cuchilla Negra, 1,600–1,700 m, Boyacá, Colombia, 17–18 Nov. 2003 (A. Gomez), in ICNB AR-2810. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellowish. Abdomen: dorsum with large posterior, longitudinal black patches, anterior and on sides patches with white pigment spots (Fig. 522). Posterior eye row straight. Ocular quadrangle square. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.9 diameter apart, 1.0 from laterals. Posterior median eyes 0.7 diameter apart, 1.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 3.4 mm. Carapace 1.4 mm long, 1.2 wide in thoracic region, 0.6 wide behind lateral eyes, 0.8 high. First femur 1.3 mm, patella and tibia 1.7, metatarsus 1.4, tarsus 0.7. Second patella and tibia 1.1 mm, third 0.9, fourth 1.5.

Male paratype. Coloration as in female. Posterior eye row slightly recurved. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.9 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 1.0 diameter apart, 0.7 from laterals. Posterior median eyes 1.0 diameter apart, 0.8 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Total length ca. 2.0 mm. Carapace 1.2 mm long, 0.8 wide in thoracic region, 0.3 wide behind lateral eyes, 0.7 high. First femur 1.2 mm, patella and tibia 1.3, metatarsus 0.9, tarsus 0.5. Second patella and tibia 1.2 mm, third 0.7, fourth 1.1.

Males and females were collected together.

Diagnosis. The ventral view of the *M. boyaca* epigynum (Fig. 520) is similar to that of *M. tarma* (Fig. 505) and *M. oxapampa* (Fig. 512). It differs in posterior view: *M. boyaca* has the median plate flanked by deep grooves (Fig. 521), whereas *M. tarma* and *M. oxapampa* lack these grooves (Fig. 506, 513).

Males lack a macroseta on the venter of the fourth femur and are distinguished from others by the large, distal spine of the terminal apophysis of the palpus, whose edge is visible (2 h of Fig. 523), and by the thin embolus between a sclerotized, pointed median apophysis and conductor (center of Fig. 523).

Natural History. The specimens were collected at the edge and interior of a forest.

Distribution. Only known from central Colombia (Map 5G).

Specimens Examined. No other specimens have been collected.

Mangora fornicate (Keyserling)
Figures 524–533; Map 5H

Epeira fornicata Keyserling, 1864: 134, pl. 7, figs. 18–20, ♀. Two female syntypes from Bogota [Colombia], in BMNH, no. 1890.7.1.4693, examined. Keyserling, 1893: 245, pl. 12, fig. 183, ♀.
Mangora fornicata:—Simon, 1895: 789, fig. 854, carapace. Platnick, 2006.

Note. Keyserling's description and measurements fit the syntypes examined. However, his illustration of the epigynum differs. He pictured a diamond-shaped epigynum, wider than long, with a pair of dark patches, rounded at the tip. The tip of the syntype's epigynum may have broken off later. The epigynum of Keyserling's specimen is less sclerotized than recently collected specimens. They also have only one pair of spermathecae. Either the second pair was overlooked, being under tissues, or the specimens were preserved just after a molt and the second pair had not sclerotized.

Mello-Leitão's (1941: 150) citation of this species from Brazil is a misidentification.

Description. Female syntype. Prosoma yellowish. Abdomen: dorsal posterior abdominal black patches (Fig. 531). Posterior eye row slightly recurved. Ocular quadrangle slightly wider than long, anterior widest. Posterior median eyes 0.9 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.7 diameter apart, 0.8 from laterals. Posterior median eyes 0.5 diameter apart, 1.2 from laterals. Height of clypeus equals 1.2 diameters of anterior median eyes. First and fourth legs subequal in length. Total length 4 mm. Carapace 1.6 mm long, 1.2 wide in thoracic region, 0.6 wide behind lateral eyes, 1.0 high. First femur 1.5 mm, patella and tibia 1.7, metatarsus 1.3, tarsus 0.6. Second patella and tibia 1.6 mm, third 1.1. Fourth femur 1.5 mm, patella and tibia 1.7, metatarsus 1.3, tarsus 0.6.

Male from Santander. Coloration as in female. Posterior eye row straight. Ocular quadrangle is as long as anterior width, anterior widest. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.8 diameter apart, 1.2 from laterals. Posterior median eyes 0.6 diameter apart, 1.5 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 3.0 mm. Carapace 1.6 mm long, 1.4 wide in thoracic region, 0.6 wide behind lateral eyes, 1.2 high. First femur 1.8 mm, patella and tibia 2.0, metatarsus 1.5, tarsus 0.8. Second patella and tibia 1.7 mm, third 1.0, fourth 1.7.

Males and females have been collected together.

Variation. Total length of females 3.7 to 4.7 mm. Figures 524–526, 531 were made from syntypes, others of specimens from Santander. Apparently the epigynum breaks after mating, making a second mating more difficult. Just handling may break the tip. The collections examined contained 18 specimens with tips and 11 with broken tips.

Diagnosis. The epigynum is heavily sclerotized. No other species of *Mangora* has a tongue-shaped epigynum like that of *M. fornicata* (Fig. 527). In the broken epigynum (Figs. 524, 529), the almost rectangular median plate (Figs. 525, 530) is diagnostic.

The male palpus, unlike that of other species, has a massive median apophysis, and the terminal apophysis has a large prong near its tip (Figs. 532, 533).

Natural History. The specimens were collected on their webs.

Distribution. Central Colombia (Map 5H).

Specimens Examined. COLOMBIA *Santander:* Piedecusta, Estacion Experimental Demostrativa El Rasgón, 2,240–2,320 m, July 2000–Feb. 2002, 29♀, 3♂ (E. Blanco, ICNB AR-1951); Tona, vereda El Brasil, 1,800 m, 23 June 2004, 1♀ (L. Benavides, ICNB AR-3425).

Mangora taboquinha new species
Figures 534–537; Map 5H

Holotype. Female holotype from Taboquinha, Parque Nacional da Serra do Divisor, Acre, Brazil, 17 Nov. 1996 (R. S. Vieira), in IBSP 9219. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma orange-yellow, posterior median eyes with black rings. Abdomen: dorsum with a pair of posterior black patches, smaller patches anterior of black ones (Fig. 536); venter lighter gray; sides with posterior dark gray patch (Fig. 537). Posterior eye row slightly recurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 0.8 diameter apart, 2.0 from laterals. Posterior median eyes 0.3 diameter apart, 2.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Fourth legs are longer than the first. Total length 6.3 mm. Carapace 2.3 mm long, 2.0 wide in thoracic region, 0.9 wide behind lateral eyes, 1.3 high. First femur 2.7 mm, patella and tibia 3.2, metatarsus 2.6, tarsus 1.0. Second patella and tibia 2.9 mm, third 2.0. Fourth femur 3.0, patella and tibia 3.4, metatarsus 2.7, tarsus 0.9.

The male is not known.

Diagnosis. The small tongue of the epigynum, about as long as wide, resembles that of *M. chacobo* (Figs. 324–327). Unlike *M. chacobo, M. taboquinha* has a raised oval median plate in posterior view (Fig. 535).

Distribution. Upper Amazon: western Brazil (Map 5H).

Specimens Examined. No other specimens have been found.

Mangora manglar new species
Figures 538–540; Map 5H

Holotype. Female holotype from 16 km S Manglar Alto, Guayas, Ecuador, 30 Jan. 1955 (E. I. Schlinger, E. S. Ross), in CAS. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellow. Abdomen: whitish; dorsum with white pigment spots and with two posterior gray pigment patches (Fig. 540); venter with white spots, anterior and lateral to spinnerets. Posterior eye row recurved. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.6 diameter apart, 0.6 from laterals. Posterior median eyes 0.3 diameter apart, 1.0 from laterals. Height of clypeus equals 0.7 diameter of anterior median eye. Total length 4.7 mm. Carapace 1.7 mm long, 1.4 wide in thoracic region, 0.6 wide behind lateral eyes, 1.3 high. First femur 1.5 mm, patella and tibia 1.5, metatarsus 1.2, tarsus 0.7. Second patella and tibia 1.8 mm, third 1.1. Fourth femur 1.8 mm, patella and tibia 1.8, metatarsus 1.6, tarsus 0.7.

The male is not known.

Diagnosis. The *M. manglar* epigynum has a tongue as long as wide, but unlike that of *M. taboquinha* (Fig. 534), the tongue has a lip and is flanked by a notch (Fig. 538).

Distribution. Only known from coastal southern Ecuador (Map 5H).

Specimens Examined. No other specimens were found.

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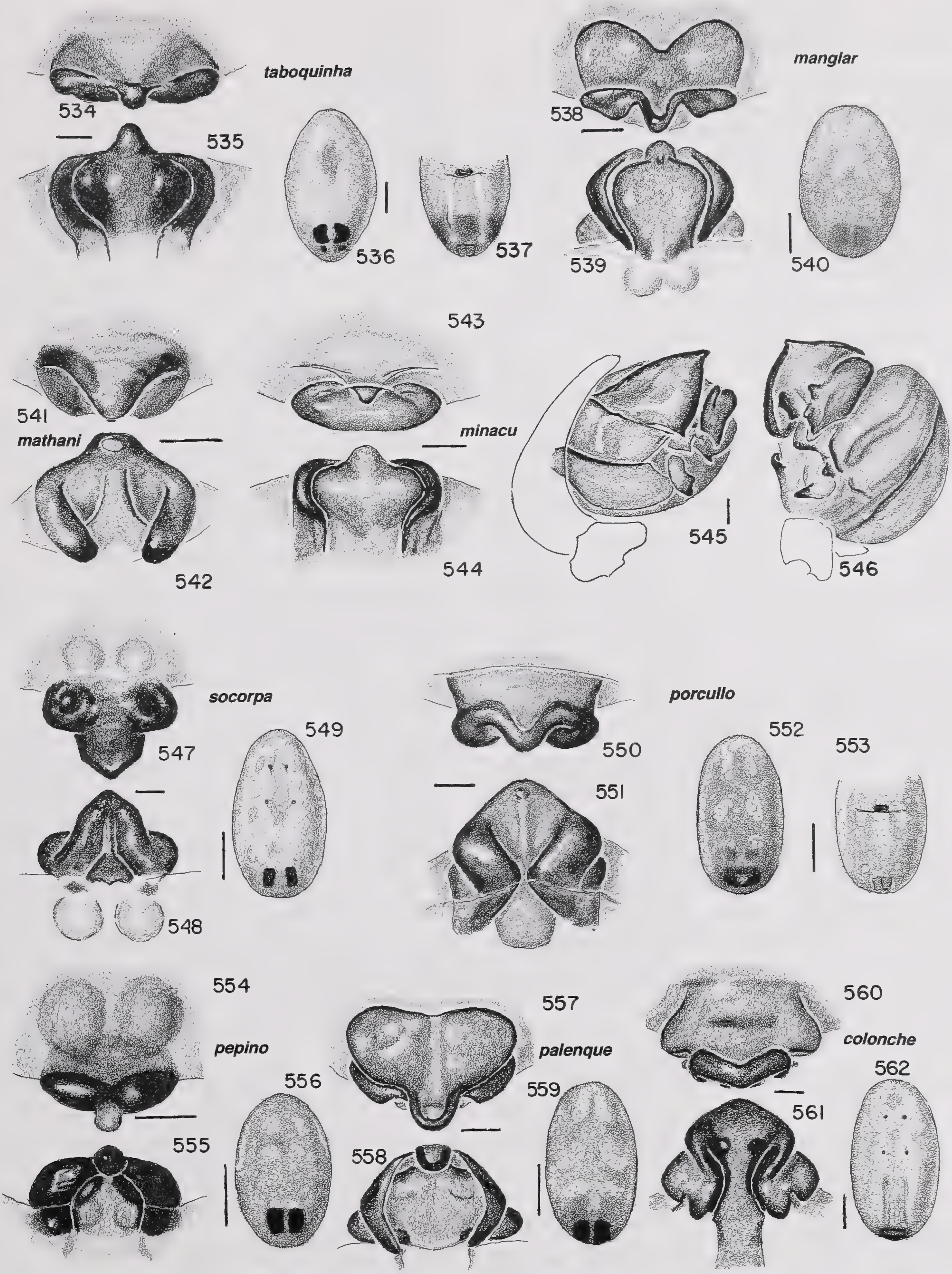
Figures 534–537. *Mangora taboquinha* new species, female. 534, 535, epigynum. 534, ventral; 535, posterior. 536, abdomen, dorsal. 537, abdomen, ventral.

Figures 538–540. *M. manglar* new species, female. 538, 539, epigynum. 538, ventral; 539, posterior. 540, abdomen, dorsal.

Figures 541, 542. *M. mathani* Simon, female, epigynum. 541, ventral; 542, posterior.

Figures 543–546. *M. minacu* new species. 543, 544, female, epigynum. 543, ventral; 544, posterior. 545, 546, left male palpus. 545, mesal; 546, ventral.

Figures 547–549. *M. socorpa* new species, female. 547, 548, epigynum. 547, ventral; 548, posterior. 549, abdomen, dorsal.



Figures 550–553. *M. porcullo* new species, female. 550, 551, epigynum. 550, ventral; 551, posterior. 552, abdomen, dorsal. 553, abdomen, ventral.

Figures 554–556. *M. pepino* new species, female. 554, 555, epigynum. 554, ventral; 555, posterior. 556, abdomen, dorsal.

Figures 557–559. *M. palenque* new species, female. 557, 558, epigynum. 557, ventral; 558, posterior. 559, abdomen, dorsal.

Figures 560–562. *M. colonche* new species, female. 560, 561, epigynum. 560, ventral; 561, posterior. 562, abdomen, dorsal.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

Mangora minacu new species
Figures 543–546; Map 4D

Holotype. Female holotype and male paratype from Usina Hidroelétrica de Serra da Mesa Minaçú, Goiás [13°43′S, 47°50′W], Brazil, 1–10 Nov. 1996 (A. Bonaldo and L. Moura), in MCN 27830. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellowish. Abdomen: dorsum with pigment spots and two black posterior patches (as in Fig. 536); venter with lateral bands of white pigment spots and a white patch on each side anterior and lateral of spinnerets. Posterior eye row recurved. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.6 diameter apart, 1.3 from laterals. Posterior median eyes 0.3 diameter apart, 2.0 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Total length 6.0 mm. Carapace 2.1 mm long, 1.7 wide in thoracic region, 0.8 wide behind lateral eyes, 1.3 high. First femur 2.4 mm, patella and tibia 2.7, metatarsus 2.2, tarsus 0.8. Second patella and tibia 2.5 mm, third 1.7. Fourth femur 2.7 mm, patella and tibia 2.8, metatarsus 2.3, tarsus 0.8.

Male paratype [just molted]. Prosoma orange. Posterior eye row recurved. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 1.2 diameters apart, 1.0 from laterals. Posterior median eyes 0.8 diameter apart, 2.0 from laterals. Height of clypeus equals 1.3 diameters of anterior median eyes. Total length 4.6 mm. Carapace 2.0 mm long, 1.7 wide in thoracic region, 0.7 wide behind lateral eyes, 1.3 high. First femur 2.4 mm, patella and tibia 2.5, metatarsus 2.2, tarsus 0.8. Second patella and tibia 2.2 mm, third 1.4, fourth 2.4.

Male and female have been collected together.

Diagnosis. The *M. minacu* epigynum (Figs. 543, 544) is similar to that of *M. taboquinha* (Figs. 534, 535), but differs by having the posterior median plate shorter (Fig. 544).

The male palpus in mesal view, unlike palpi of other species, has the terminal apophysis with a large triangular shield hiding the embolus (12 h in Fig. 545).

Distribution. Only known from Goyás, Brazil, Amazon region (Map 4D).

Specimens Examined. No other specimens have been found.

Mangora socorpa new species
Figures 547–549; Map 5I

Holotype. Female holotype from Finca San José, 8 km SE Socorpa Mission, Sierra de Perija, 1,450–1,500 m [10°06′N, 73°04′W Depto. César], Colombia, 27–31 July 1968 (B. Malkin), in AMNH. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma orange, dorsum of carapace and distal articles of legs darker, very small black circles around secondary eyes. Abdomen: orange-white; dorsum with two posterior black rectangles (Fig. 549); venter with white pigment; sides orange-white with a white spot anterior and lateral to spinnerets. Posterior eye row slightly recurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 1.0 diameter apart, 2.0 from laterals. Posterior median eyes 0.3 diameter apart, 1.3 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 5.5 mm. Carapace 2.1 mm long, 1.6 wide in thoracic region, 1.1 wide behind lateral eyes, 1.2 high. First femur 2.3 mm, patella and tibia 2.6, metatarsus 2.2, tarsus 0.8. Second patella and tibia 2.4 mm, third 1.4, fourth 2.3.

The male is not known.

Diagnosis. The ventral view of the *M. socorpa* epigynum differs from all others by having a pair of depressions on lobes flanking the tongue (Fig. 547) and, in posterior view, unlike others with a similar scape, a triangular median plate with a

narrow, median, ventral extension (Fig. 548).

Distribution. Northern Colombia (Map 5I).

Paratypes. COLOMBIA *César:* Finca San José, 8 km SE Socorpa Mission, Sierra de Perija, 1,500–1,600 m, forest trail, 16–17 Aug. 1968, 7♀ (B. Malkin, AMNH), 1,450–1,500 m, 27–31 July 1968, 1♀ (B. Malkin, AMNH).

Mangora porcullo new species
Figures 550–553; Map 5I

Holotype. Female holotype and one female paratype from ravines west of Porcullo, Central Cordillera, Cajamarca, Peru, 15, 19 May l967 (A. F. Archer, S. Risco), in AMNH. The specific name is a noun in apposition after the type locality.

Description. Female. Prosoma yellow. Abdomen: dorsum with many white pigment spots, and posterior black, connected rectangles (Fig. 552). Posterior eye row recurved. Ocular quadrangle square. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 0.8 diameter apart, 1.5 from laterals. Posterior median eyes 0.8 diameter apart, 2.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 5.0 mm. Carapace 2.0 mm long, 1.8 wide in thoracic region, 0.8 wide behind lateral eyes, 1.1 high. First femur 2.3 mm, patella and tibia 2.6, metatarsus 2.3, tarsus 0.9. Second patella and tibia 2.5 mm, third 1.6. Fourth femur 2.3 mm, patella and tibia 2.7, metatarsus 2.0, tarsus 0.7.

The male is not known.

Variation. Total length of females 5.0 to 5.2 mm.

Diagnosis. Mangora porcullo is smaller than *M. colonche* (Figs. 560–562), and the epigynum differs by having a more acute tongue flanked by a lobe (Fig. 550). In both species, the posterior median plate has a constriction (Figs. 551, 561).

Distribution. Northwestern Peru (Map 5I).

Specimens Examined. PERU *Piura:* Canchaque, 05°23′S, 79°37′W, 1,750–1,800 m, 4 May 1956, 1♀ (H. W. and M. Koepcke, MUSM).

Mangora pepino new species
Figures 554–556; Map 6B

Holotype. Female holotype and one female paratype from El Pepino [Pepino, Putumayo, 01°03′N, 76°38′W], Colombia, 21 Feb. 1973 (N. Leist), in IBSP 10769a. The specific name is a noun in apposition after the type locality. Pepino is a cucumber in Spanish.

Description. Female holotype. Prosoma yellow, with gray shadows on sides of carapace. Abdomen: light yellowish; dorsum with anterior paired areas of white spots and a pair of posterior black patches (Fig. 556). Posterior eye row procurved. Ocular quadrangle as long as posterior width, posterior widest. Posterior median eyes 1.1 diameters of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 1.0 diameter apart, 0.8 from laterals. Posterior median eyes 1.0 diameter apart, 1.0 from laterals. Height of clypeus equals 0.6 diameter of anterior median eyes. Total length 3.3 mm. Carapace 1.3 mm long, 1.2 wide in thoracic region, 0.6 wide behind lateral eyes, 0.8 high. First femur 1.5 mm, patella and tibia 1.7, metatarsus 1.3, tarsus 0.8. Second patella and tibia 1.6 mm, third 1.0, fourth 1.6.

The male is not known.

Diagnosis. The *M. pepino* epigynum, unlike others, in ventral view has a pair of wide, heavily sclerotized swelling along the rim (Fig. 554) and heavily sclerotized short lateral plates in posterior view (Fig. 555).

Distribution. Only known from southern Colombia (Map 6B).

Specimens Examined. No other specimens have been found.

Mangora palenque new species
Figures 557–559; Map 6B

Holotype. Female holotype from Río Palenque, 47 km SW Santo Domingo de los Colorados, road to Quevedo, Los Ríos, Ecuador, 16 Mar. 1982 (Y. Lubin 367), in MCZ. The specific name is a noun in apposition after the type locality.

Description. Female paratype. Prosoma orange. Abdomen: orange-white; dorsum with anteriorly paired fields of white pigment spots and posterior pair of black

patches (Fig. 559); venter with a pair of white pigment spots anterior and lateral to spinnerets. Posterior eye row slightly procurved. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.5 diameter apart, 0.6 from laterals. Posterior median eyes 0.3 diameter apart, 1.2 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 4.8 mm. Carapace 2.0 mm long, 1.6 wide in thoracic region, 0.6 wide behind lateral eyes, 1.1 high. First and fourth legs subequal in length. First femur 2.1 mm, patella and tibia 2.2, metatarsus 1.7, tarsus 0.7. Second patella and tibia 2.1 mm, third 1.4. Fourth femur 2.1 mm, patella and tibia 2.3, metatarsus 1.8, tarsus 0.7.

The male is not known.

Variation. Total length of females 3.6 to 5.0 mm.

Diagnosis. The epigynum of *M. palenque* (Fig. 557) in ventral view is similar to that of *M. manglar* (Fig. 538), but the sclerotized base (Fig. 557) lacks the anterior median notch and lips along the rim flanking the tongue (Fig. 557).

Natural History. One specimen was collected in a Malaise trap.

Distribution. Ecuador (Map 6B).

Paratypes. ECUADOR *Los Ríos:* Río Palenque, 47 km SW Santo Domingo de los Colorados, road to Quevedo, 14 Mar. 1982, 1♀ (Y. D. Lubin 369, MCZ); Río Palenque, 3 Mar. 1985, 1♀ (L. Arrea, MECN); Río Palenque, 47 km S Santo Domingo, Pichincha, 5 May–25 June 1985, 1♀ (S. and J. Peck, AMNH).

Specimens Examined. ECUADOR *Pichincha:* Tinalandia, ca. 830 m, 12 km E Santo Domingo de los Colorados, 11–17 May 1986, 2♀ (G. B. Edwards, FSCA).

Mangora colonche new species
Figures 560–562; Map 6B

Holotype. Female holotype from Colonche, Guayas, Ecuador, 1941 (R. W. Landes), in the Exline-Peck Collection of CAS. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma orange. Abdomen: dorsum with a posterior black patch and a median gray band fading anteriorly surrounded by white pigment spots (Fig. 562). Posterior eye row recurved. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 1.2 diameters apart, 2.0 from laterals. Posterior median eyes 0.6 diameter apart, 2.3 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. First and fourth legs of subequal length. Total length 5.5 mm. Carapace 2.7 mm long, 2.3 wide in thoracic region, 1.0 wide behind lateral eyes, 1.2 high. First femur 3.6 mm, patella and tibia 3.9, metatarsus 3.6, tarsus 1.3. Second patella and tibia 3.7 mm, third 2.3. Fourth femur 3.6 mm, patella and tibia 3.9, metatarsus 3.8, tarsus 1.2.

The male is unknown.

Variation. Total length of females 5.5 to 5.9 mm.

Diagnosis. Mangora colonche is larger than *M. porcullo*, and the epigynum differs in ventral view by having a shorter, wider tongue (Fig. 560). (The tongue is bent ventrally in Fig. 560.) In posterior view both species, unlike others, have a median plate with a neck (Figs. 551, 561).

Distribution. Southwestern Ecuador and northwestern Peru (Map 6B).

Specimens Examined. PERU *Tumbes:* Matapalo, Río Zarumilla, 27–29 Apr. 1956, 1♀ (H. W. and M. Koepcke, MUSM). *Piura:* Canchaque, 05°23′S, 79°37′W, 1,750–1,800 m, 4 May 1956, 1♀ (H. W. and M. Koepcke, MUSM).

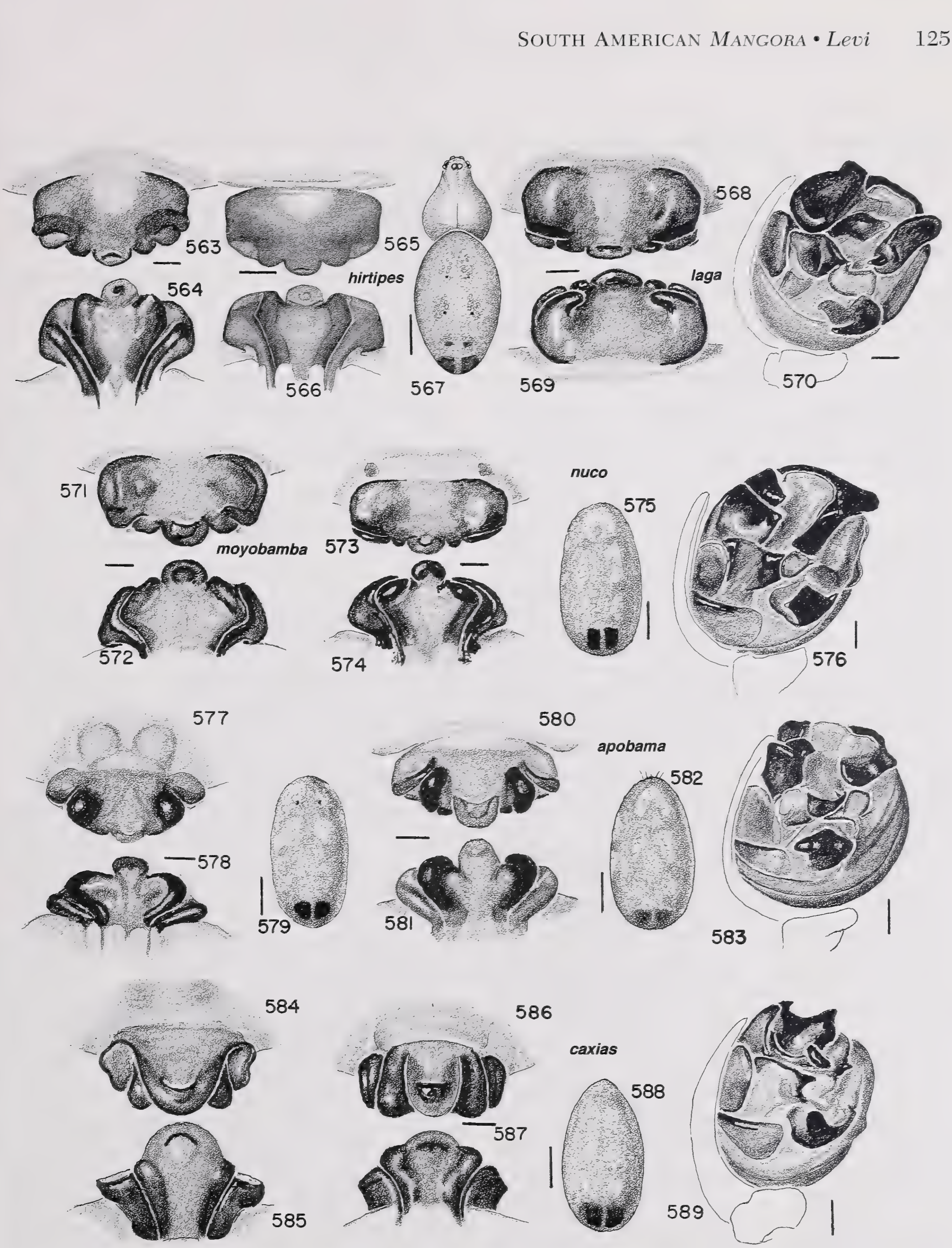
Mangora hirtipes (Taczanowski)
Figures 563–567; Map 5E

Epeira hirtipes Taczanowski, 1878, 164: pl. 2, fig. 15, ♀. Female lectotype and one female paralectotype,

→

Figures 563–567. *Mangora hirtipes* (Taczanowski), female. 563–566, epigynum. 563, 565, ventral; 564, 566, posterior. 567, carapace, abdomen.

Figures 568–570. *M. laga* new species. 568, 569, female, epigynum. 568, ventral; 569, posterior. 570, left male palpus, mesal.



Figures 571, 572. *M. moyobamba* new species, female, epigynum. 571, ventral; 572, posterior.

Figures 573–576. *M. nuco* new species. 573–575, female. 573, 574, epigynum. 573, ventral; 474, posterior. 575, abdomen, dorsal. 576, male palpus, mesal.

Figures 577–583. *M. apobama* new species. 577–582, female. 577, 578, 580, 581, epigynum. 577, 580, ventral; 578, 581, posterior. 579, 582, abdomen, dorsal. 583, male palpus, mesal.

Figures 584–589. *M. caxias* new species. 584–588, female. 584–587, epigynum. 584, 586, ventral; 585, 587, posterior. 588, abdomen, dorsal. 589, male palpus, mesal.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

here designated, from Amable María [Dept. Junín, Prov. Tarma, 640 m, on Río Chanchamayo], Peru, ca. 1870s, in PAN, examined.
Aranea hirtipedata Roewer, 1942: 844. (Replacement name for *Aranea hirtipes* which is preoccupied.)
Mangora hirtipes:—Levi, 1991: 177. Platnick, 2006.

Description. Female holotype. Prosoma orange. Abdomen: light orange; dorsum with a pair of posterior black patches and pairs of patches containing white pigment spots (Fig. 567). Posterior eye row straight. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.5 diameter apart, 1.0 from laterals. Posterior median eyes 0.4 diameter apart, 1.2 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Total length 5.3 mm. Carapace 2.2 mm long, 1.7 wide in thoracic region, 0.8 wide behind lateral eyes, 1.3 high. First femur 2.1 mm, patella and tibia 2.3, metatarsus 1.7, tarsus 0.7. Second patella and tibia 2.2 mm, third 1.5. Fourth femur 2.2 mm, patella and tibia 2.4, metatarsus 1.8, tarsus 0.8.

The male is not known.

Variation. Total length of females 4.5 to 5.6 mm. Figures 565–567 were made from the female lectotype, Figures 563, 564 from a specimen from the Upper Amazon, Brazil.

Diagnosis. The *M. hirtipes* epigynum has the wide tongue flanked by two lobes (Figs. 563, 565) and can be distinguished from others by the posterior view of the epigynum (Figs. 564, 566), with V-shaped openings anterior to the depression between sclerites (Figs. 564, 566).

Distribution. Guyana and Amazon region (Map 5E).

Specimens Examined. GUYANA Canje Ikuruwa River, 05°50′N, 57°50′W, Aug.–Dec. 1961, 4♀ (G. Bentley, AMNH). BRAZIL *Pará:* Caxiuanã, Melgaço, 6–16 Aug. 1996, 5♀ (A. A. Lise, MCP 9317, 9378, 9379, 9381); Rio Mapuera, 16 km S of the equator, 1♀ (AMNH). *Amazonas:* Parque Nacional do Pico da Neblina, 12 Oct. 1990, 1♀ (A. A. Lise, MCP); Tefé, Fonte Boa, São Paulo de Olivença, before 1880, 1♀ (M. de Mathan, MNHN); Tefé, Nov.–Dec. 1919, 1♀ (H. S. Parrish, MCZ). *Acre:* Rio Purus, W of Sena Madureira, Boca do Chandless, 5 Sep. 1973, 1♀ (B. Patterson, MCZ).

Mangora laga new species
Figures 568–570; Map 5E

Holotype. Female holotype from Cucharas, Huallaga Valley, Dept. Huánuco, Peru, Feb.–Apr. 1954 (F. Woytkowski), in CAS. The specific name is an arbitrary combination of letters.

Description. Female holotype. Prosoma orange-yellow. Abdomen: whitish; dorsum with areas of white pigment spots and a pair of posterior black patches (as in Fig. 575). Posterior eye row straight. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.6 diameter apart, 0.6 from laterals. Posterior median eyes 0.6 diameter apart, 1.3 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length ca. 4.0 mm. Carapace 1.7 mm long, 1.5 wide in thoracic region, 0.7 wide behind lateral eyes, 1.1 high. First femur 1.7 mm, patella and tibia 2.1, metatarsus 1.6, tarsus 0.7. Second patella and tibia 2.1 mm, third 1.4. Fourth femur 2.1 mm, patella and tibia 2.3, metatarsus 1.6, tarsus 0.8.

Male. Coloration as in female. Posterior eye row procurved. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.6 diameter apart, 0.4 from laterals. Posterior median eyes 0.3 diameter apart, 1.1 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Fourth femur with ventral, proximal macroseta. Total length 3.3 mm. Carapace 1.7 mm long, 1.4 wide in thoracic region, 0.6 wide behind lateral eyes, 1.1 high. First femur 2.0 mm, patella and tibia 2.1, metatarsus 1.5, tarsus 0.7. Second patella and tibia 1.8 mm, third 1.3, fourth 2.0.

Male and female were matched because both are relatively small specimens, with a pair of black patches on the posterior of the abdomen, and were collected in the

same vicinity of Huánuco, Peru. The match is uncertain.

Diagnosis. Mangora laga female can be separated from others by the posterior view of the epigynum, which has a pair of fingers near the rim, pointing at each other (Fig. 569).

The palpus of the male is separated from others by the spine of the median apophysis, which points toward the cymbium (5 h in Fig. 570), and by the triangular embolus (center of Fig. 570).

Distribution. Upper Amazon: Central Peru (Map 5E).

Specimens Examined. PERU *Huánuco:* Monzón Valley, Tingo María, Peru, 18 Dec. 1954, 1♂ (E. I. Schlinger, E. S. Ross, CAS).

Mangora moyobamba new species
Figures 571, 572; Map 5I

Holotype. Female holotype from 32 km southeast of Moyobamba, San Martín, Peru, June 1947 (F. Woytkowski), in AMNH. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellowish. Abdomen: dorsum with patches of anterior white pigment spots and two posterior gray patches (as in Fig. 567). Posterior eye row straight. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; anterior lateral eyes 0.7 diameter, posterior 0.6. Anterior median eyes 0.6 diameter apart, 0.6 from laterals. Posterior median eyes 0.3 diameter apart, 1.2 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Leg four longer than first. Total length 4.7 mm. Carapace 1.8 mm long, 1.4 wide in thoracic region, 0.7 wide behind lateral eyes, 1.3 high. First femur 1.8 mm, patella and tibia 2.2, metatarsus 1.5, tarsus 0.7. Second patella and tibia 2.0 mm, third 1.5. Fourth femur 2.1 mm, patella and tibia 2.4, metatarsus 1.6, tarsus 0.8.

The male is not known.

Diagnosis. The *M. moyobamba* epigynum can be separated from that of *M. nuco* (Fig. 573) by the longitudinal swelling on each side of the base in ventral view (Fig. 571) and from most similar species by the wider, rounded median plate in posterior view (Fig. 572).

Distribution. Upper Amazon: eastern Peru (Map 5I).

Specimens Examined. No other specimens have been found.

Mangora nuco new species
Figures 573–576; Map 6A

Holotype. Female holotype and 15 female, two male, and four immature paratypes from Cucharas, Huallaga Valley, Dept. Huánuco, Peru, Feb.–Apr. 1954 (F. Woytkowski), in CAS. The specific name is a noun, an arbitrary combination of letters.

Description. Female holotype. Prosoma orange-yellow. Abdomen: orange-white, dorsum with anterior patches of white pigment spots, and a pair of posterior black patches (Fig. 575). Posterior eye row straight. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; anterior lateral eyes 0.7 diameter, posterior 0.5. Anterior median eyes 0.7 diameter apart, 0.7 from laterals. Posterior median eyes 0.4 diameter apart, 1.5 from laterals. Height of clypeus equals 0.6 diameter of anterior median eyes. First legs and fourth subequal in length. Total length 5.2 mm. Carapace 2.1 mm long, 1.6 wide in thoracic region, 0.7 wide behind lateral eyes, 1.1 high. First femur 2.2 mm, patella and tibia 2.6, metatarsus 2.0, tarsus 0.7. Second patella and tibia 2.3 mm, third 1.6. Fourth femur 2.2 mm, patella and tibia 2.6, metatarsus 2.0, tarsus 0.7.

Male paratype. Color as in female. Posterior eye row straight. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.6 diameter apart, 0.5 from laterals. Posterior median eyes 0.5 diameter apart, 1.4 from laterals. Height of clypeus equals 1.2 diameters of anterior median eyes. First and fourth legs of equal length. Fourth femur with a proximal, ventral large macroseta. Total length 3.2 mm. Carapace 1.8 mm long, 1.6 wide in tho-

racic region, 0.6 wide behind lateral eyes, 1.0 high. First femur 1.9 mm, patella and tibia 2.2, metatarsus 1.6, tarsus 0.7. Second patella and tibia 1.9 mm, third 1.3. Fourth femur 1.9 mm, patella and tibia 2.1, metatarsus 1.7, tarsus 0.7.

Males and females have been collected together.

Variation. Total length of females 4.4 to 5.2 mm.

Diagnosis. The *M. nuco* epigynum can be separated from that of *M. moyobamba* (Fig. 571) by lacking longitudinal swellings on each side of the base in ventral view (Fig. 573), and in posterior view having the median plate widest ventrally (Fig. 574).

The male median apophysis of the palpus differs from all others by the wide, truncate end (4 h in Fig. 576) and the conductor hides the embolus tip (center in Fig. 576).

Natural History. Specimens were collected sweeping the understory of secondary forest in San Ramón, Peru.

Distribution. Central Peru, upper Amazon region (Map 6A).

Specimens Examined. PERU *San Martín:* Hara, 32 km SE Moyobamba, June 1947, 1♀ (F. Woytkowski, AMNH). *Huánuco:* Cucharas, Huallaga Valley, Feb.–Apr. 1954, 1♀ (F Woytkowski, CAS); Estacion Dantas, La Molina, SW de Puerto Inca, 270 m, 09°38′S, 75°00′W, 18 May–1 June 1987, 5♀ (D. Silva D., MUSM). *Junín:* San Ramón de Pangoa, 40 km S Satipo, 750 m, 26 Jan. 1974, 1♀ (R. T. Schuh, AMNH).

Mangora apobama new species
Figs. 577–583; Map 6A

Holotype. Female holotype and male paratype from Zona Reservada Tambopata, 290 m, 12°50′S, 69°17′W, Madre de Dios, Peru, 14 May–13 June 1988 (D. Silva D.), in MCZ. The name is a noun in apposition of an arbitrary combination of letters.

Description. Female holotype. Prosoma orange, with distal articles of legs darker. Abdomen: dorsum orange-white with paired patches of white pigment spots, and a pair of posterior dark gray patches (Figs. 579, 582). Posterior eye row slightly recurved. Ocular quadrangle wider than long, anterior widest. Fourth legs slightly longer than first. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.4 diameter apart, 0.4 from laterals. Posterior median eyes 0.4 diameter apart, 1.2 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 5.3 mm. Carapace 2.2 mm long, 1.7 wide in thoracic region, 0.7 wide behind lateral eyes, 1.8 high. First femur 2.2 mm, patella and tibia 2.4, metatarsus 1.7, tarsus 0.7. Second patella and tibia 2.2 mm, third 1.6. Fourth femur 1.8 mm, patella and tibia 2.5, metatarsus 1.8, tarsus 0.8.

Male from paratype. Coloration as in female. Posterior eye row slightly recurved. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 0.7 diameter of anterior medians; lateral eyes 0.4 diameter. Anterior median eyes 0.6 diameter apart, 0.5 from laterals. Posterior median eyes 0.5 diameter apart, 1.2 from laterals. Height of clypeus equals 1.2 diameters of anterior median eyes. Fourth femur with proximal, ventral macroseta. Total length 3.2 mm. Carapace 1.7 mm long, 1.4 wide in thoracic region, 0.6 wide behind lateral eyes, 1.1 high. First femur 1.6 mm, patella and tibia 1.8 metatarsus 1.3, tarsus 0.7. Second patella and tibia 1.7 mm, third 1.3. Fourth femur 1.7 mm, patella and tibia 1.8, metatarsus 1.4, tarsus 0.7.

Males and females have been collected together.

Variation. Total length of females 4.3 to 5.3 mm, males 3.0 to 3.2.

Diagnosis. The ventral view of the epigynum of *M. apobama* differs from that of *M. hirtipes* (Figs. 563, 565) and *M. caxias* (Figs. 584, 586) by having differently shaped lobes (Figs. 577, 580) and, in posterior view, a wider median plate (Figs. 578, 581). Unlike *M. caxias* (Figs. 584, 586) the tongue is just a short lobe of the rim.

The male palpus differs from others by the blunt projection of the median apophysis (6 h in Fig. 583) and the short, pointed, embolus (center in Fig. 583).

Natural History. Bottomland swamp forest in Pakitza, Peru.

Distribution. Southeastern Peru, western Brazil, and northern Bolivia, upper Amazon region (Map 6A).

Paratypes. PERU *Madre de Dios:* Zona Reservada Tambopata, 290 m, 12°50′S, 69°17′W, 4 June–3 July 1988, 2♀, 2♂ (D. Silva D., MUSM); 13 June 1988, 1♂ (J. Coddington, USNM); Río Tambopata, 30 Mar. 1988 (J. Palmer, D. Smith, MCZ); Río de la Torre, Río Tambopata, 12°50′S, 69°17′W, July–Aug. 1979, 3♀, 3♂ (A. Rypstra, USNM).

Specimens Examined. PERU *Madre de Dios:* 15 km E Puerto Maldonado on Río Madre de Dios, 200 m, 23, 28 June 1983, 3♀ (G. C. Hunter, CAS); 15 km E Puerto Maldonado, Río Madre de Dios, 3–27 June 1983, 3♀ (G. C. Hunter, CAS); Zona Reservada del Manu, Puesto de Vigil, Pakitza, 11°58′S, 71°18′W, 2, 3, 7 Oct. 1987, 3♀ (D. Silva D., J. Coddington, USNM). BRAZIL *Acre:* Pimenteira, Xapurí, 5–7 Apr. 1996, 1♀ (IBSP/SMNK, IBSP 16038); Reserva Extrativista Humaitá, Rio Branco, 12 Apr. 1996, 5♀ (IBSP, SMNK staff, IBSP 15725). BOLIVIA *Beni:* Chacobo Indian Village, Río Benicito, 12°30′S, 66°W, 10–20 July 1960, 5♀ (B. Malkin, AMNH).

Mangora caxias new species
Figures 584–589; Map 4F

Holotype. Female holotype, one female and one male paratypes from Salto Caxias, Rio Iguaçú, Capitão Leônidas Marques, Paraná, Brazil, 20–28 March 1993 (A. B. Bonaldo), in MCN 23306. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellow. Abdomen: dorsum whitish with median and transverse rows of pigment spots and two posterior black patches (Fig. 588). Posterior eye row procurved. Ocular quadrangle almost rectangular, slightly longer than wide. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 1.1 diameters apart, 1.0 from laterals. Posterior median eyes 0.6 diameter apart, 1.5 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 4.7 mm. Carapace 1.7 mm long, 1.4 wide in thoracic region, 0.6 wide behind lateral eyes, 0.9 high. First femur 1.8 mm, patella and tibia 2.2, metatarsus 1.4, tarsus 0.7. Second patella and tibia 1.8 mm, third 1.3. Fourth femur 1.9 mm, patella and tibia 2.2, metatarsus 1.7, tarsus 0.7.

Male paratype. Coloration as in female. Posterior eye row slightly procurved. Ocular quadrangle as long as wide, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.8 diameter apart, 0.6 from laterals. Posterior median eyes 0.6 diameter apart, 1.2 from laterals. Height of clypeus equals 1.3 diameters of anterior median eyes. Fourth femur with a ventral, proximal macroseta. Total length 3.2 mm. Carapace 1.7 mm long, 1.4 wide in thoracic region, 0.7 wide behind lateral eyes, 1.2 high. First femur 1.7 mm, patella and tibia 1.8, metatarsus 1.3, tarsus 0.7. Second patella and tibia 1.7 mm, third 1.1. Fourth femur 1.7 mm, patella and tibia 1.8, metatarsus 1.4, tarsus 0.7.

Males and females were collected together.

Variation. Total length of females 4.3 to 5.0 mm, males 3.2 to 3.4.

Diagnosis. The *M. caxias* epigynum is separated from that of *M. apobama* (Figs. 577, 580) by having sclerites flanking the tongue in a longitudinal, rather than diagonal, orientation (Figs. 584, 586) and, in posterior view, by having wide lateral plates (Figs. 585, 587). The tongue, unlike that of *M. apobama* (Figs. 577, 580), is attached on the anterior of the epigynum (Figs. 584, 586).

The male palpus differs from that of *M. apobama* (Fig. 583) in having the median apophysis projection wider (4 h in Fig. 589), the embolus smaller, and its tip bent proximally (center in Fig. 589).

Distribution. Southern Brazil and northeastern Argentina (Map 4F).

Specimens Examined. BRAZIL *São Paulo:* Porto Cabral, Rio Paraná, 1941, 1♀ (L. T. Filho, MZSP 4767). *Mato Grosso:* Santo Antônio de Leverger, 29 July 1992, 1♀ (A. A. Lise, A. Braul, MCP 2395). *Paraná:* Foz do Iguaçú, 29–30 Mar. 1993, 1♀, 1♂ (A. B. Bonaldo, MCN 23490). ARGENTINA *Misiones:* Parque Nacional Iguazú, 8–15 Feb. 1993, 2♀ (M. J. Ramírez, MACN).

Mangora alinahui new species
Figures 590–594; Map 6A

Holotype. Female holotype from Alinahui, 450 m, 20 km E Puerto Napo, 01°00′S, 77°25′W, Napo, Ec-

uador, Nov., Dec. 1995 (E. S. Ross), in CAS. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma golden yellow, distal leg articles darker. Abdomen: dorsum with anterior patches of white pigment spot, with a pair of posterior gray patches (Fig. 592). Posterior eye row slightly recurved. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 0.7 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.5 diameter apart, 1.2 from laterals. Posterior median eyes 0.5 diameter apart, 2.0 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Total length 6.5 mm. Carapace 2.5 mm long, 1.8 wide in thoracic region, 0.9 wide behind lateral eyes, 1.3 high. First femur 2.4 mm, patella and tibia 2.7, metatarsus 2.2, tarsus 0.8. Second patella and tibia 2.6 mm, third 1.7. Fourth femur 2.6 mm, patella and tibia 3.0, metatarsus 2.3, tarsus 0.9.

Male from Circuata Cajuta, Bolivia. Prosoma orange, eye region gray. Abdomen: dorsum with pairs of white pigment spots and a posterior pair of black squares anterior to which are a pair of gray marks; venter with white pigment spots. Posterior eye row slightly recurved. Ocular quadrangle slightly wider than long, anterior widest. Posterior median eyes 0.9 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 1.0 diameter apart, 1.0 from laterals. Posterior median eyes 1.0 diameter apart, 1.2 from laterals. Height of clypeus equals 1.5 diameters of anterior median eyes. Total length 3.0 mm. Carapace 1.3 mm long, 1.1 wide in thoracic region, 0.3 wide behind lateral eyes, 0.5 high. First femur 1.3 mm, patella and tibia 1.5, metatarsus 1.1, tarsus 0.5. Second patella and tibia 1.4 mm, third 0.8, fourth 1.3.

Male and females have not been collected together but were collected from adjacent localities in Bolivia. Because the male is smaller than expected, they may not belong together.

Variation. Total length of females 5.2 to 6.5 mm.

Diagnosis. In ventral view, the epigynum of *M. alinahui* has a scape, constricted at its origin, flanked by two lobes, the outside one larger (Fig. 590); whereas in *M. lechugal*, the sides of the scape are straight and the outside lobe is less sclerotized (Fig. 595). In posterior view, *M. alinahui* has a median plate with slightly rounded sides (Fig. 591), whereas in *M. lechugal*, the median plate is narrow and constricted (Fig. 596).

Unlike those of other *Mangora* species, the male palpus has various unusual structures (center to 12 h in Fig. 594). Their homology could not be ascertained.

Distribution. Amazon region: Ecuador, Brazil, and Bolivia (Map 6A).

Specimens Examined. BRAZIL *Amazonas:* Manaus, Reserva Florestal Adolpho Ducke, 18 Dec. 1987, 1♀ (A. A. Lise, MCN 27428). BOLIVIA *La Paz:* Yungas Mapiri, N La Paz [above 4,000 m], 11–17 Aug. 1989, 1♀ (L. E. Peña, AMNH); Yungas La Paz, Circuata Cajuta, 2,400 m, 3–7 Dec. 1984, 1♂ (L. E. Peña, AMNH).

Mangora lechugal new species
Figures 595–599; Map 6A

Holotype. Female holotype and one female paratype from Lechugal [Tumbes Prov.], Peru, 1875–1885 (J. Sztolcman), in PAN. The specific name is a noun in apposition after the type locality.

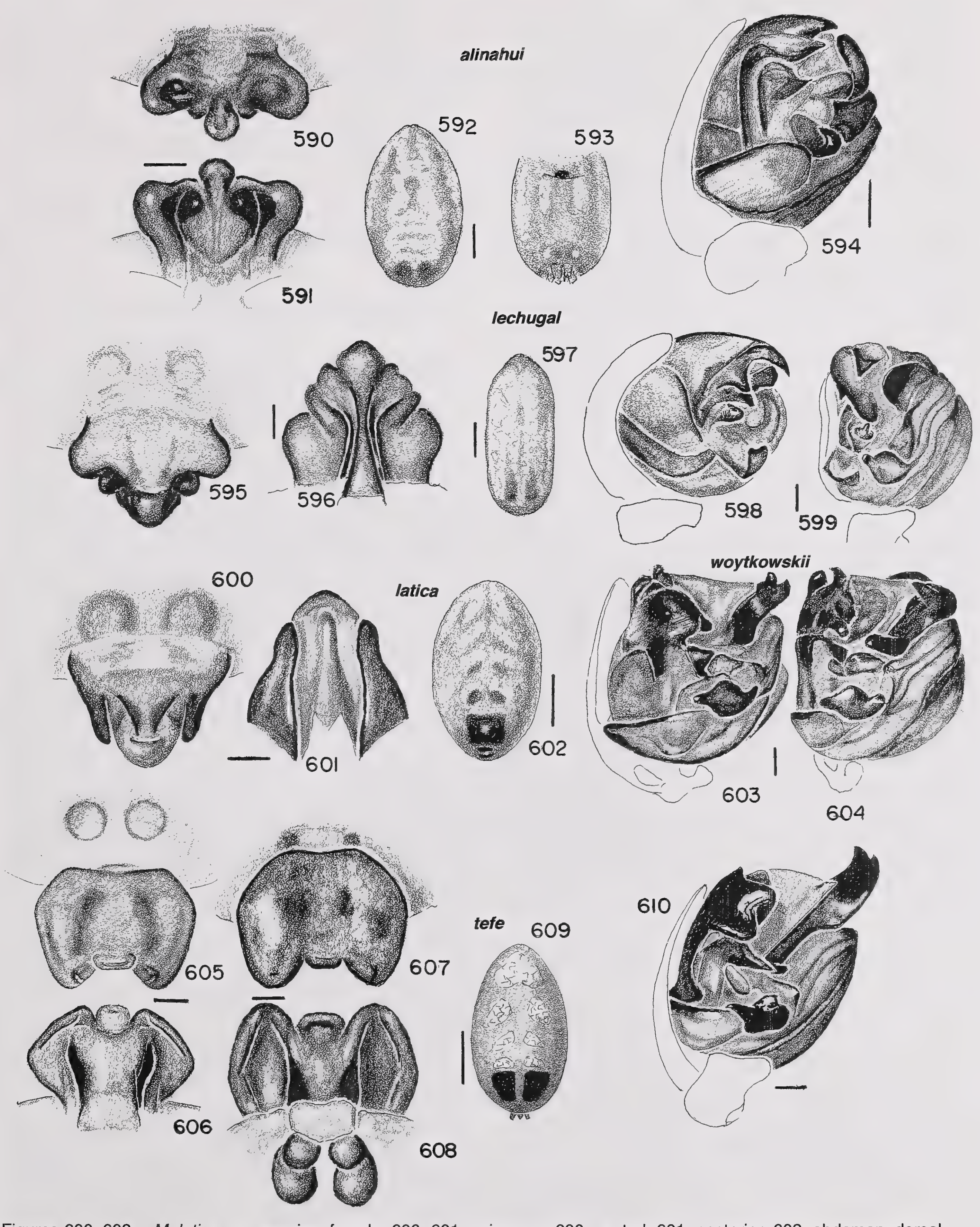
Note. Lechugal is on Río Zarumilla (Levi, 1964).

Description. Female holotype. Prosoma

→

Figures 590–594. *Mangora alinahui* new species. 590–593, female. 590, 591, epigynum. 590, ventral; 591, posterior. 592, abdomen, dorsal. 593, abdomen, ventral. 594, left male palpus, mesal.

Figures 595–599. *M. lechugal* new species. 595–597, female. 595, 596, epigynum. 595, ventral; 596, posterior. 597, abdomen, dorsal. 598, 599, male palpus. 598, mesal; 599, ventral.



Figures 600–602. *M. latica* new species, female. 600, 601, epigynum. 600, ventral; 601, posterior. 602. abdomen, dorsal.

Figures 603, 604. *M. woytkowskii* new species, male palpus. 603, mesal; 604, ventral.

Figures 605–610. *M. tefe* new species, female. 605–609, epigynum. 605, 607, ventral; 606, 608, posterior. 609, abdomen, dorsal. 610, male palpus, mesal.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

yellow. Abdomen: slender, with black rectangles fading anteriorly (Fig. 597); venter anterior on sides with some white pigment spots. Posterior eye row straight. Ocular quadrangle slightly wider than long, anterior widest. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 1.0 diameter apart, 1.2 from laterals. Posterior median eyes 0.3 diameter apart, 2.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 5.8 mm. Carapace 2.1 mm long, 1.8 wide in thoracic region, 0.8 wide behind lateral eyes, 1.4 high. First femur 3.0 mm, patella and tibia 3.3, metatarsus 3.1, tarsus 1.2. Second patella and tibia 3.1 mm, third 2.0. Fourth femur 2.7 mm, patella and tibia 3.3, metatarsus 3.1, tarsus 1.0.

Male from Palmal. Coloration as in female except with less black eye pigment. Posterior eye row straight. Ocular quadrangle slightly wider than long, anterior widest. Posterior median eyes 0.7 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.6 diameter apart, 0.6 from laterals. Posterior median eyes 0.5 diameter apart, 1.5 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Venter of fourth femur with proximal macroseta. Total length 4.2 mm. Carapace 2.1 mm long, 1.7 wide in thoracic region, 0.7 wide behind lateral eyes, 0.8 high. First femur 2.6 mm, patella and tibia 2.9, metatarsus 2.8, tarsus 1.2. Second patella and tibia 2.7 mm, third 1.6, fourth 2.8.

The association of male and female is uncertain.

Diagnosis. The epigynum of *M. lechugal* is weakly sclerotized (Fig. 595) and is distinguished from that of *M. alinahui* in posterior view: *M. alinahui* (Fig. 591) has a wide median plate, whereas *M. lechugal* has a very narrow, constricted one (Fig. 596).

The male palpus (Figs. 598, 599) has a terminal apophysis with two spurs in mesal view, resembling those of *M. pia* (Fig. 614) and *M. bambusa* (Fig. 620). It differs by the shape of the median apophysis (4 h in Fig. 598) and the large lobe of the terminal apophysis in ventral view (2 h in Fig. 599).

Distribution. Upper Amazon: southern Ecuador, northwestern Peru (Map 6A).

Specimens Examined. ECUADOR Palmal [Palmales, El Oro, 03°41′S, 80°07′W, 93 m (Paynter, 1993)], 1875–1885, 1♂ (J. Sztolcman, PAN).

Mangora latica new species
Figures 600–602; Map 6C

Holotype. Female holotype from 10 km E Santa Leticia, Huila, Finca Meremberg, 2,300 m, Colombia, Mar. 1979 (W. Eberhard), in MCZ. The name is an arbitrary combination of letters.

Description. Female holotype. Carapace yellow. Labium, endites, sternum orange. Legs, including coxae, yellow. Abdomen: whitish; dorsum has areas with white pigment spots and black and gray patches (Fig. 602); venter with a pair of small areas of white pigment spots. Posterior eye row straight. Ocular quadrangle longer than wide, anterior slightly widest. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes their diameter apart, 1.0 from laterals. Posterior median eyes 0.6 diameter apart, 1.4 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Total length 4.4 mm. Carapace 1.7 mm long, 1.4 wide in thoracic region, 0.7 wide behind lateral eyes, 0.9 high. First femur 1.8 mm, patella and tibia 2.1, metatarsus 1.7, tarsus 0.8. Second patella and tibia 1.9 mm, third 1.2, fourth 1.9.

The male is unknown.

Variation. Total length of females 3.7 to 4.4 mm.

Diagnosis. In ventral view, the distinctive *M. latica* epigynum, has a tongue flanked by a pair of lobes and a median keel terminating in the distal pocket of the scape (Fig. 600). The posterior view, a longer than wide median plate, has a keel (Fig. 601); the median sides of the pointed lateral plates are parallel (Fig. 601).

Natural History. A specimen was col-

lected in secondary cloud forest in Depto. Cundinamarca, Colombia.

Distribution. Upper Amazon: Colombia (Map 6C).

Paratype. COLOMBIA *Huila:* La Plata, Reserva Meremberg, 2,300 m, 13 Oct. 1992, 1♀ (E. Flórez, ICNB AR-167).

Specimens Examined. COLOMBIA *Cundinamarca:* San Antonio de Tequendama, Vereda la Rapida, Bosque de Ermitaño, 2,000 m, Dec. 1997, June 1998, 1♀ (S. Forero R., ICNB AR-2459).

Mangora woytkowskii new species
Figures 603, 604; Map 6C

Holotype. Male holotype from Divisoria, 1,400 m, Huánuco, Peru, 23 Sep.–3 Oct. 1946 (F. Woytkowski), in AMNH. The species is named after the collector.

Description. Male holotype. Prosoma light orange. Abdomen: lighter, dorsum with paired patches of white pigment spots, a posterior pair of black patches, a pair of light gray patches anterior to black patches. Posterior eye row straight. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.7 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.8 diameter apart, 0.6 from laterals. Posterior median eyes 0.8 diameter apart, 1.3 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Venter of fourth femur with proximal macroseta. Total length 3.3 mm. Carapace 1.7 mm long, 1.6 wide in thoracic region, 0.7 wide behind lateral eyes, 0.8 high. First femur 1.9 mm, patella and tibia 2.3, metatarsus 1.6, tarsus 0.7. Second patella and tibia 1.9 mm, third 0.8, fourth 2.1.

The female is not known.

Variation. Total length of males 2.7 to 3.3 mm.

Diagnosis. Mangora woytkowskii palpus differs from that of *M. tefe* (Fig. 610) by having a shorter projection on the terminal apophysis (2 h in Fig. 603) and a shorter, triangular embolus (center of Fig. 603).

Distribution. Upper Amazon region in Central Peru (Map 6C).

Specimens Examined. PERU *Huánuco:* Dantas, La Molina, SW de Puerto Inca, 270 m, 09°38′S, 75°00′W, 18 May–1 June 1987, 2♂ (D. Silva D., MUSM). *Ucayali:* Bosque Alexander von Humboldt, "El Caobal", km 8, 3 Aug. 1986, 1♂ (D. Silva D., MUSM). BRAZIL *Pará:* Jacareacanga, Oct. 1959, 2♂ (M. Alvarenga, AMNH).

Mangora tefe new species
Figures 605–610; Map 6C

Holotype. Female holotype and 10 female and three immature paratypes from Tefé, Fonte Boa, São Paulo [de Olivença, Amazonas, Brazil, ca. 1880s, probably M. de Mathan], in MNHN 2068A. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellowish-white. Abdomen: dorsum with anterior white pigment patches, a pair of posterior black patches (Fig. 609). Posterior eye row straight. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 1.0 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.4 diameter apart, 1.0 from laterals. Posterior median eyes 0.3 diameter apart, 1.5 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 4.8 mm. Carapace 1.8 mm long, 1.4 wide in thoracic region, 0.7 wide behind lateral eyes, 1.2 high. First femur 1.6 mm, patella and tibia 2.2, metatarsus 1.6, tarsus 0.7. Second patella and tibia 2.0 mm, third 1.4. Fourth femur 1.8 mm, patella and tibia 2.2, metatarsus 1.7, tarsus 0.7.

Male from Alto Solimões, Brazil. Light yellowish. Abdomen: lighter, dorsum with a pair of posterior black squares. Posterior eye row slightly procurved. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.7 diameter of anterior medians; lateral eyes 0.4 diameter. Anterior median eyes 0.5 diameter apart, 0.5 from laterals. Posterior medians 1.0 diameter of anterior median eyes. Fourth femur with a long, ventral, proximal macroseta. Total length 3.7 mm. Carapace 1.8 mm long, 1.5 wide in thoracic region, 0.6 wide behind lateral eyes, 1.2 high. First femur 1.8 mm, patella and tibia 2.2, meta-

tarsus 1.5, tarsus 0.8. Second patella and tibia 1.8 mm, third 1.2, fourth 2.0.

Males and females have been collected together.

Variation. Total length of females 3.8 to 5.4 mm, males 2.8 to 3.7 mm. Figures 605, 606, 609 were illustrated from the holotype, Figures 607, 608 from a specimen from Ecuador.

Diagnosis. Mangora tefe epigynum differs from that of all other *Mangora* by having a broad plate at the base of the epigynum, wider than long, and a short, wide tongue within a notch of the plate (Figs. 605, 607). In posterior view, the raised median plate is flanked by a pair of elongate depressions (Figs. 606, 608).

The *M. tefe* male palpus differs from that of *M. woytkowskii* (Fig. 603) by having a longer terminal apophysis projection (2 h in Fig. 610) and a longer, triangular embolus (center in Fig. 610).

Natural History. Specimens have been collected in moist tropical forest in Depto. Meta, and in forest canopy in Depto. Vaupés, Colombia.

Distribution. Upper Amazon: Colombia, Ecuador and western Brazil (Map 6C).

Specimens Examined. COLOMBIA *Meta:* Macarena, Río Duda, 450 m, Dec. 1992, 3♀, 4 imm. (A. Calixto, ICNB AR-2997); Parque Nacional Natural Macarena, Centro de Investigaciones Ecologicas, 150 m, 29 Oct. 1998, 1♀ (A. Calixto, ICNB AR-3486). *Vaupés:* Taraira, Serr. Taraira, Caño Pintadillo, 01°01′S, 69°39′W, Mar. 2002, 5♀, 1♂, 2 imm. (J. Pinzón, ICNB AR-3335); Bajo Río Apaporis, Lago Taraira, Estación Biológica Caparú, 01°04′S, 69°31′W, Sep. 2002–May 2003, 9♀, 3♂, 9 imm. (L. Benavides, ICNB AR-2989A, 3327, 3329); Bajo Rio Apaporis, Lago Taraira, Estación Biológica Caparú, 01°04′S, 69°31′W, May 2001, 2♀ (J. Pinzón, Y. A. Sabogal, ICNB AR-3340). *Amazonas:* Corr. La Mathani, Quebradón El Ayo, 01°35′S, 69°31′W, May 2002, 1♀, 1♂, 3 imm. (J. Pinzón, MCZ). ECUADOR *Napo:* Reserva Forestal Cuyabeno, Lago Grande, 27 July 1985, 1♀ (L. Avilés, MECN). BRAZIL *Amazonas:* Alto Solimões, Dec. 1979, 1♂ (A. A. Lise, MCN 8893). *Acre:* Parque Nacional da Serra do Divisor, Várzea Gibralta-Pedro, 19 Nov. 1996, 1♀ (R. S. Vieira, IBSP 9336).

Mangora pia Chamberlin and Ivie
Figures 611–615; Map 5H

Mangora pia Chamberlin and Ivie, 1936: 58, pl. 12, fig. 112, ♀. Female holotype from Barro Colorado Island, Panama, in AMNH, examined. Chickering, 1954: 208, figs. 18–21, ♀♂; Levi, 2005: 176, figs. 200–207, ♀♂; Platnick, 2006.

M. belligerens Chamberlin and Ivie, 1936: 60, pl. 12, fig. 113, ♂. Male holotype from Barro Colorado Island, Panama, in AMNH, examined. First synonymized by Chickering, 1954.

M. wiedenmeyeri Schenkel, 1953: 18, fig. 15, ♀. Female holotype from El Pozón, Falcón, Venezuela, in NHMB, examined. Synonymized by Levi, 2005.

Description. Description in Levi (2005). Total length of females 5.0 to 6.7 mm, males 3.3 to 4.3.

Diagnosis. Mangora pia epigynum is heavily sclerotized and is distinguished from others by having a median notch in ventral view, framed by sclerotized folds (Fig. 611).

The male palpus is distinguished from others by the projecting terminal apophysis (12 h in Figs. 614, 615) and a single median projection from the median apophysis (5 h in Fig. 614).

Natural History. Specimens have been found in forest in Panama.

Distribution. Panama to northern Brazil (Map 5H).

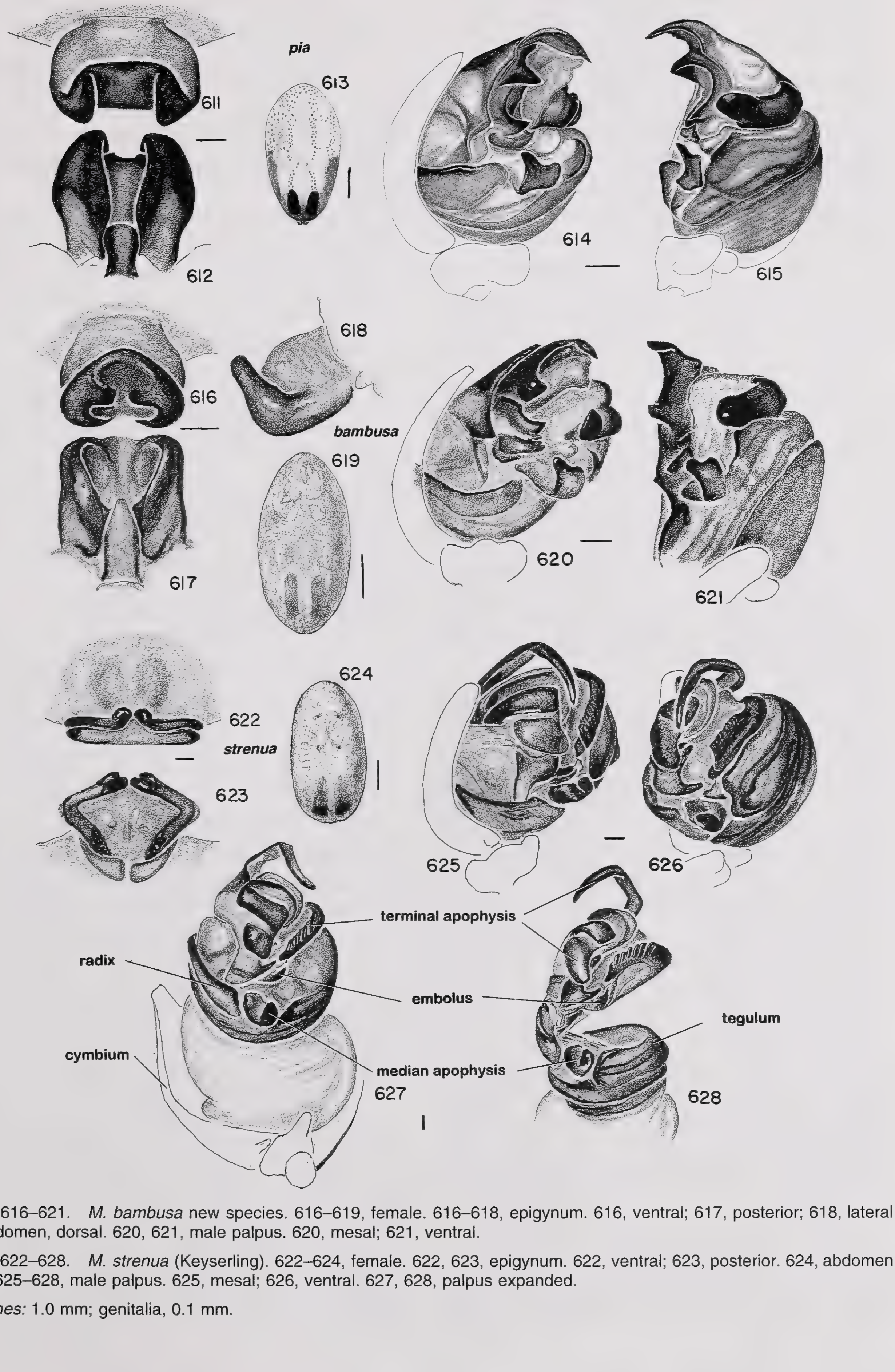
Specimens Examined. Central American specimens were listed in Levi (2005). COLOMBIA *Bolívar:* St. Catalina, Hacienda da El Ceibal, 20 m, Oct. 1999, 1♀ (E. Flórez, ICNB AR-1587). *Valle:* nr. Cali, 1,000 m, 3♀ (W. Eberhard 1128, 1131, 1132, MCZ); Río Jamundi nr. Jamundi, 9 Dec. 1969, 1♀ (W. Eberhard, MCZ). BRAZIL *Roraima:* São Gabriel da Cachoeira, Ilha de Maracá, May 1992, 1♀ (M. Nascimento, MCP 1961).

Mangora bambusa new species
Figures 616–621; Map 6B

Holotype. Female holotype and three female paratypes from Cali, Valle, Colombia, 1,000 m, 30 Dec.

→

Figures 611–615. *Mangora pia* Chamberlin and Ivie. 611–613, female. 611, 612, epigynum. 611, ventral; 612, posterior. 613, abdomen, dorsal. 614, 615, left male palpus. 614, mesal; 615, ventral.



Figures 616–621. *M. bambusa* new species. 616–619, female. 616–618, epigynum. 616, ventral; 617, posterior; 618, lateral. 619, abdomen, dorsal. 620, 621, male palpus. 620, mesal; 621, ventral.

Figures 622–628. *M. strenua* (Keyserling). 622–624, female. 622, 623, epigynum. 622, ventral; 623, posterior. 624, abdomen, dorsal. 625–628, male palpus. 625, mesal; 626, ventral. 627, 628, palpus expanded.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

1976 (H. Levi), in MCZ. The species is named after its habitat of bamboo forest; the name is a noun in apposition.

Description. Female holotype. Prosoma light yellowish. Abdomen: lighter; dorsum with areas of white spots and two posterior rectangular gray patches (Fig. 619); venter with a pair of white spots anterior and lateral to spinnerets; sides with white spots. Posterior eye row slightly recurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 0.7 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 0.7 diameter apart, 1.1 from laterals. Posterior median eyes 0.2 diameter apart, 1.2 from laterals. Height of clypeus equals 0.7 diameter of anterior median eyes. Abdomen narrow (Fig. 619). Total length 5.3 mm. Carapace 2.2 mm long, 1.6 wide in thoracic region, 0.7 wide behind lateral eyes, 1.4 high. First femur 2.6 mm, patella and tibia 2.9, metatarsus 2.3, tarsus 1.0. Second patella and tibia 2.6 mm, third 1.7. Fourth femur 2.7 mm, patella and tibia 2.8, metatarsus 2.2, tarsus 0.9.

Male paratype. Coloration as in female. Posterior eye row recurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 0.7 diameter of anterior medians; lateral eyes 0.5 diameter. Anterior median eyes 0.6 diameter apart, 0.6 from laterals. Posterior median eyes 0.4 diameter apart, 1.2 from laterals. Height of clypeus equals 0.7 diameter of anterior median eye. Fourth femur with proximal, ventral macroseta. Total length 3.8 mm. Carapace 2.0 mm long, 1.6 wide in thoracic region, 0.7 wide behind lateral eyes, 0.9 high. First femur 2.2 mm, patella and tibia 2.7, metatarsus 2.3, tarsus 0.9. Second patella and tibia 2.2 mm, third 1.4. Fourth femur 2.3 mm, patella and tibia 2.3, metatarsus 2.1, tarsus 0.8.

The male and female were collected in adjacent areas.

Variation. Total length of females 4.8 to 6.0 mm. The epigynal depressions of all specimens were filled with white mucus, which was difficult to remove. The illustrations were made from the female holotype and male paratype.

Diagnosis. The *M. bambusa* epigynum (Fig. 616) differs from all other species by having two pairs of depressions in ventral view (Fig. 616). In posterior view there is a triangular depressions containing the median plate (Fig. 617).

The male palpus is similar to that of *M. pia* (Figs. 614, 615), but the embolus tip appears notched (center pointing toward 3 h in Fig. 620), and most sclerites are slightly differently shaped (Figs. 620, 621).

Natural History. Females were collected from bamboo forest and the male from a grazed field adjacent to the bamboo.

Distribution. Southwestern Colombia (Map 6B).

Paratypes. COLOMBIA *Valle:* Cali, 1,000 m, 30 Dec. 1976, 1♂ (H. Levi, MCZ).

Specimens Examined. No other specimens have been collected.

Mangora strenua (Keyserling)
Figures 622–628; Map 6D

Epeira strenua Keyserling, 1893: 257, pl. 13, fig. 192, ♀. Female holotype from Taquara, Rio Grande do Sul [Brazil], in BMNH, lost.

Araneus strenuus:—Petrunkevitch, 1911: 318.

Mangora strenua:—Mello-Leitão, 1943: 184; Platnick, 2006.

Note. Although the holotype has been lost, Keyserling's (1893) illustration makes this large common species recognizable.

Description. Female. Prosoma orange. Abdomen: dorsum with white pigment spots and two posterior black patches, fading out anteriorly (Fig. 624). Posterior eye row recurved. Ocular quadrangle rectangular, slightly longer than wide. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 1.0 diameter apart, 2.0 from laterals. Posterior median eyes 0.6 diameter apart, 2.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 7.2 mm. Carapace 2.5 mm long, 2.1 wide in thoracic region, 0.9 wide behind lateral eyes, 1.7 high. First femur 2.8 mm, patella and tibia 3.2, meta-

tarsus 2.8, tarsus 1.0. Second patella and tibia 3.0 mm, third 2.1. Fourth femur 3.0 mm, patella and tibia 3.2, metatarsus 2.7, tarsus 1.0.

Male. Abdomen: dorsum with posterior fading black marks, four indistinct anterior gray patches, white near gray patches and along two lateral lines on dorsum. Posterior eye row recurved. Ocular quadrangle slightly wider than long, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.8 diameter. Anterior median eyes 1.0 diameter apart, 1.4 from laterals. Posterior median eyes 0.5 diameter apart, 1.5 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Fourth femur with a proximal, ventral small macroseta. Total length 5.7 mm. Carapace 2.7 mm long, 2.3 wide in thoracic region, 0.8 wide behind lateral eyes, 1.4 high. First femur 2.8 mm, patella and tibia 3.3, metatarsus 2.7, tarsus 1.2. Second patella and tibia 3.0 mm, third 2.0. Fourth femur 3.0 mm, patella and tibia 3.3, metatarsus 3.0, tarsus 1.0.

Males and females have been collected together.

Variation. Total length of females 5.5 to 7.2 mm, males 5.3 to 7.1.

Diagnosis. Mangora strenua females differ from all other species by having an unusual epigynum: In ventral view two transverse dark folds along the rim meet at midline (Fig. 622) and in posterior view is a large diamond-shaped median plate framed by dark folds (Fig. 623).

The male is distinguished by a distal terminal apophysis projection bent toward the mesal side (12 h in Figs. 625–628).

Natural History. The species has been found in forest on Pico da Tijuca and in bamboo undergrowth in Teresópolis.

Distribution. Southern Brazil, northeastern Argentina (Map 6D).

Specimens Examined. BRAZIL *Minas Gerais:* Lavras, 29 Mar. 1979, 1♀ (W. D. Fronk, MCZ). *Rio de Janeiro:* Rio de Janeiro, 1♀ (C. F. de Mello-Leitão, MNRJ 279); Parque Nacional da Tijuca, Pico da Tijuca, 500–950 m, 17 Apr. 1965, 1♀ (H. Levi, MCZ); Teresópolis, Parque Nacional da Serra dos Orgãos, 1,000–1,800 m, 19 Apr. 1965, 3♀ (H. Levi, MCZ); Teresópolis, 900–1,000 m, Mar. 1946, 2♀, 1♂ (H. Sick, AMNH). *São Paulo:* Botucatu, Parque Municipal de Botucatu, 12 Feb. 1987, 2♀, 1♂ (I. M. P. Rinaldi, L. C. Forti, UBTU); Salesópolis, Estação Biológica de Boracéia, 10 Feb. 1997, 1♂ (L. S. Rocha, IBSP 11957); Cocaia, May 1951, 1♀ (H. Urban, MZSP 9531); Cotia, Mar. 2003, 5♀, 3♂ (A. A. Nogueira, H. Y. Yamaguti, MZSP); Salesópolis, Estação Ecológica de Boracéia, 10 Apr. 2000, 1♀ (A. D. Brescovit et al., IBSP 27090); 15 km E Guapiara, Fazenda Intervales, Feb. 1990, 2♀, 1♂ (W. Eberhard 3568, 3583, MCZ); Mogi das Cruzes, 4 Jan. 1995, 4♀ (R. Martins, IBSP 14248); São Paulo, Jardim Botânico, 19 Mar. 1985, 1♀ (H., L. Levi, MCZ); São Paulo, Mata do Governo, Instituto de Botânica, 4 Mar. 1959, 1♂ (L. Lane, AMNH). *Paraná:* Curitiba, 4♀ (Z. Rohr, MNRJ); Rio Branco do Sul, 16 Apr. 1987, 4♀ (A. D. Brescovit, MCN 17141); Almirante Tamandaré, Terra Boa, 5 Apr. 1987, 1♀ (A. D. Brescovit, MCN 16952); Rio Azul, 3 Apr. 1993, 1♂ (R. Bóçon, MCN 23608); Ponta Grossa, Vila Velha, 23 Feb. 1987, 1♂ (Equipe Profaupar, MCN 20353). *Santa Catarina:* Rio Negrinho, Distrito de Volta Grande, 7–10 Apr. 2001, 2♀ (A. Chagas-Jr., MNRJ 2102). *Rio Grande do Sul:* Bom Jesus, Fazenda Aver, 24 Mar. 1989, 3♀ (A. B. Bonaldo, MCN 18420); Cambará do Sul, 11–13 Apr. 1994, 9♀ (M. A. L. Marques, MCN 25408); Cambara do Sul, Itaimbézinho, 16 June 1983, 1♀; 27 April 1985, 1♀, 1♂ (A. Lise, MCN); 10 June 1985, 1♀ (A. A. Lise, MCN 13302); Campo Bom, 29 Apr. 1998, 1♂ (C. J. Becker, MCN 19434); Canela, 20 Mar. 1976, 1♀ (A. A. Lise, MCN 3886); 5 May 1984, 1♀ (M. Hoffmann, MCN 12196); 3 July 1965, 1♀ (A. A. Lise, MCN 4088); Curitiba, 24 Feb. 1978, 1♂ (R. Yzmota, MCN 9151); Arroio do Tigre, Itaúba, 19 Apr. 1978, 1♀ (H. Bischoff, MCN 7967); Maquiné, Estacão Experimental da Fepagro, 6–8 Mar. 1998, 11♀, 1♂ (A. B. Bonaldo, MCN 29001); Machadinho, 8–14 Feb. 1983, 1♂ (A. B. Bonaldo, MCN 18188); Machadinho, Linha do Tigre, 9–10 May 2001, 1♀ (R. Ott, L. Moura, MCN 33836); Nova Petrópolis, 7 Apr. 1973, 1♀ (A. A. Lise, MCN 828); 7 July 1973, 1♀ (A. A. Lise, MCN 1446); Novo Hamburgo, 17 June 1986, 2♀ (C. J. Becker, MCN 15162); Porto Alegre, 15 May 1966, 2♀ (A. A. Lise, MCN 163); Porto Alegre, Morro Santana, 5 Jan. 1968, 1♀ (A. A. Lise, MCN 461); Porto Alegre, Belém Novo, 27 June 1993, 1♀ (R. Balestrin, MCP 3472); São Francisco de Paula (many collections); Serra do Pinto, Josafaz, Terra de Areia, 20 May 1996, 1♀ (T. Strehl, MCN 27619); Três Cachoeras, 25 Feb. 1989, 1♀ (L. Moura, MCN 19596); Torres, 8 May 1994, 1♀ (A. A. Lise, MCP 4837); Triunfo, 16–17 Mar. 1998, 1♀ (L. Moura, MCN 29161); Vacaria, 21–25 Apr. 1982, 2♀ (A. A. Lise, MCN 10236); Viamão, 1959, 1♀ (A. A. Lise, MCN 9333); Viamão, Parque Saint Hilaire, 7 Jan. 1976, 1♀ (E. H. Buckup, MCN 4248); 30 Apr. 1976, 1♀ (A. A. Lise, MCN 4153); Vila Oliva, 5, 6 Apr. 1975, 11♀, 3♂ (A. Lise, MCN 2674, 2675); 4 Apr. 1975, 3♀ (C. Becker, MCN 2679); 15 Jan. 1976, 1♀

(E. H. Buckup, MCN 3700). ARGENTINA *Misiones:* Tobuna, July–Aug. 1959, 1♀ (O. De Ferraris, AMNH).

Mangora nonoai new species
Figures 629–632; Map 2D

Holotype. Female holotype from Parque Florestal Estadual de Nonoai, Nonoai, Rio Grande do Sul, Brazil, 14 Jan. 1985 (A. A. Lise), in MCN 12822. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma orange; carapace with symmetrical light areas (Fig. 631). Abdomen: dorsum with three pairs of white patches and a pair of posterior dark gray patches (Fig. 631); venter with a pair of white spots anterior and lateral to spinnerets; sides with some white spots. Posterior eye row slightly recurved. Ocular quadrangle longer than wide, anterior widest. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 1.2 diameters apart, 2.0 from laterals. Posterior median eyes 0.3 diameter apart, 2.0 from laterals. Height of clypeus equals 0.8 diameter of anterior median eyes. Total length 7.0 mm. Carapace 2.6 mm long, 2.1 wide in thoracic region, 0.9 wide behind lateral eyes, 1.6 high. First femur 2.5 mm, patella and tibia 3.0, metatarsus 2.2, tarsus 0.9. Second patella and tibia 2.7 mm, third 1.8. Fourth femur 2.8 mm, patella and tibia 3.0, metatarsus 2.7, tarsus 0.9.

Male from São Paulo State. Coloration as in female but fewer white spots. Posterior eye row slightly recurved. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.4 diameter. Anterior median eyes 0.6 diameter apart, 1.2 from laterals. Posterior median eyes 0.3 diameter apart, 1.6 from laterals. Height of clypeus equals 0.7 diameter of anterior median eyes. Total length 4.8 mm. Carapace 2.2 mm long, 1.8 wide in thoracic region, 0.7 wide behind lateral eyes, 1.3 high. First femur 2.3 mm, patella and tibia 2.6, metatarsus 2.0, tarsus 0.8. Second patella and tibia 2.2 mm, third 1.6, fourth 2.5.

Males and females have been collected together.

Variation. Total length of females 6.6 to 7.0 mm, males 4.6 to 4.8.

Diagnosis. The *M. nonoai* epigynum, unlike others, has a median notch in ventral view, framed by two transverse folds (Fig. 629). In posterior view, two wide lateral plates are separated by a seam in midline (Fig. 630).

In the male, the palpus differs from others by the median apophysis that has moved distally and ventrally (3 h in Fig. 632). The finger-shaped sclerite in the center is probably part of the terminal apophysis.

Natural History. Eberhard (personal communication) writes that his specimens were found in "early second growth, 2 ft. [60 cm] above ground, male in curled retreat at top anchor of web. The web was inclined, closer to horizontal than to vertical".

Distribution. Southern Brazil (Map 2D).

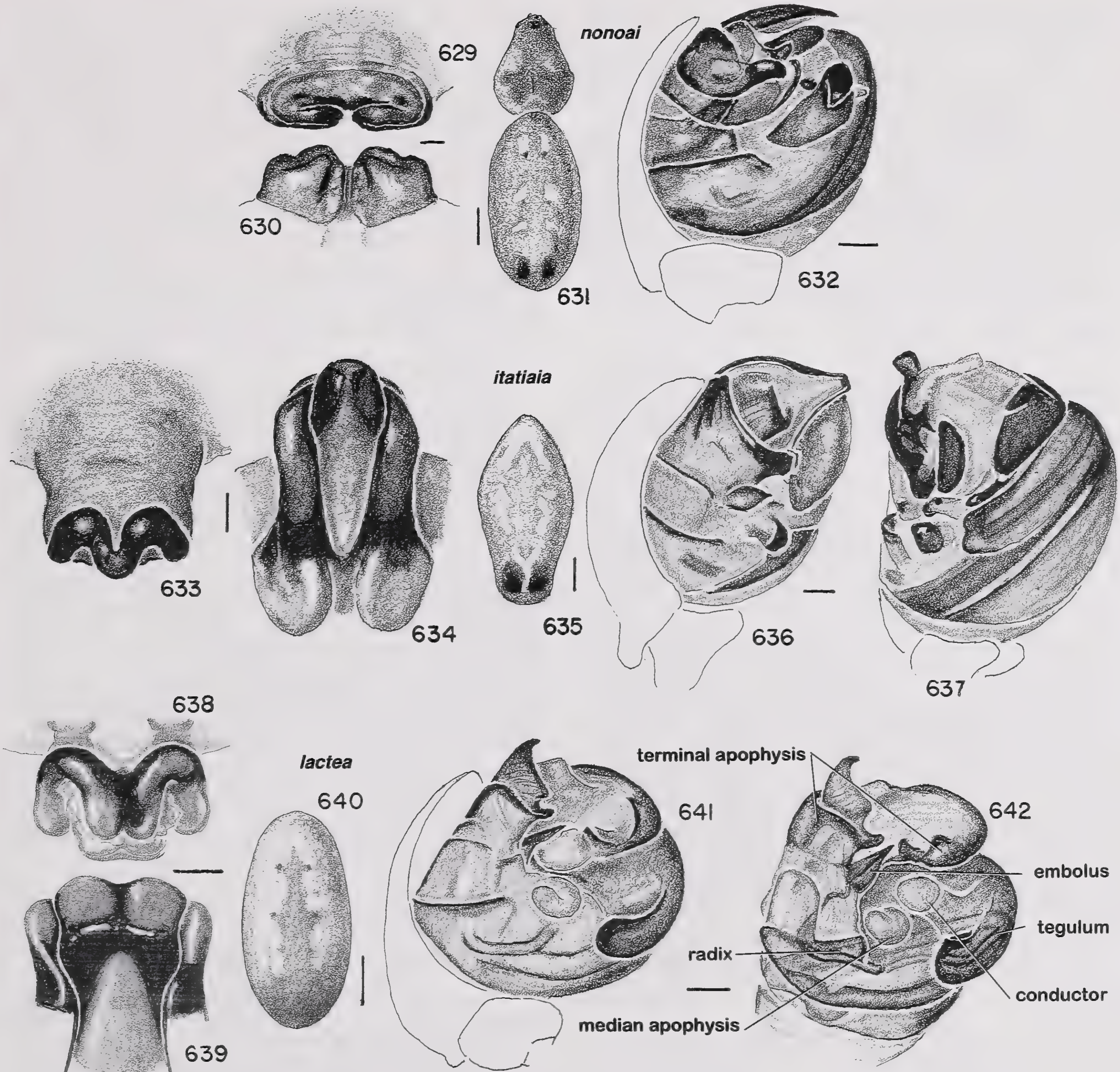
Paratypes. BRAZIL *São Paulo:* 15 km E Guapiara, Fazenda Intervales, 700 m, Feb. 1990, 2♀, 1♂ (W. Eberhard 3577, MCZ).

Specimens Examined. No other specimens have been found.

Mangora itatiaia new species
Figures 633–637; Map 4I

Holotype. Female holotype from Parque Nacional do Itatiaia, Itatiaia, Rio de Janeiro, Brazil, June 2001 (H. F. Japyassú et al.), in IBSP no. 28915. The specific name is a noun in apposition after the type locality.

Description. Female holotype. Prosoma yellow. Abdomen: lighter yellowish; dorsum with patches of white pigment spots, posterior with a pair of black patches fading anteriorly (Fig. 635); venter with median line of white spots. Posterior eye row straight. Ocular quadrangle as long as anterior width, anterior widest. Posterior median eyes 1.2 diameters of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 1.0 diameter apart, 1.2 from laterals. Posterior median eyes 0.5 diameter apart, 2.0 from laterals. Height of clypeus



Figures 629–632. *Mangora nonoai* new species. 629–631, female. 629, 630, epigynum. 629, ventral; 630, posterior. 631, carapace, abdomen. 632, left male palpus, mesal.

Figures 633–637. *M. itatiaia* new species. 633–635, female. 633, 634, epigynum. 633, ventral; 634, posterior. 635, abdomen, dorsal. 636, 637, male palpus. 636, mesal; 637, ventral.

Figures 638–642. *M. lactea* Mello-Leitão. 638–640, female. 638, 639, epigynum. 638, ventral; 639, posterior. 640, abdomen, dorsal. 641, 642, male palpus. 641, mesal; 642, expanded.

Scale lines: 1.0 mm; genitalia, 0.1 mm.

equals 1.0 diameter of anterior median eyes. Total length 6.7 mm. Carapace 2.6 mm long, 2.2 wide in thoracic region, 1.0 wide behind lateral eyes, 1.4 high. First femur 3.1 mm, patella and tibia 3.3, metatarsus 2.7, tarsus 1.2. Second patella and tibia 3.0 mm, third 2.0. Fourth femur 3.1 mm, patella and tibia 3.4, metatarsus 2.4, tarsus 0.8.

Male from Espírito Santo. Coloration as in female. Posterior eye row straight. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.7 di-

ameter. Anterior median eyes 1.2 diameters apart, 1.2 from laterals. Posterior median eyes 1.0 diameter apart, 2.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 6.0 mm. Carapace 2.5 mm long, 2.2 wide in thoracic region, 0.8 wide behind lateral eyes, 1.3 high. First femur 2.5 mm, patella and tibia 3.0, metatarsus 2.4, tarsus 0.8. Second patella and tibia 2.6 mm, third 1.6, fourth, 2.8.

Males and females were not collected together; their match is uncertain. Similarities are the size, coloration, and shape of abdomen.

Diagnosis. The *M. itatiaia* epigynum (Fig. 633) is similar to that of *M. lactea* (Fig. 638), but in ventral view, a swollen fold is curved along the midline forming a notched tongue, flanked by two loops (Fig. 633), whereas in *M. lactea*, the folds have fused in midline (Fig. 638). In posterior view, *M. itatiaia* differs from all other species by having a long median plate framed by long lateral plates fused dorsally (Fig. 634), whereas in *M. lactea*, the sides are separated (Fig. 639).

The heavily sclerotized palpus differs by having a central truncated sclerite (center of Fig. 636).

Distribution. Southeastern Brazil (Map 4I).

Specimens Examined. BRAZIL *Espírito Santo:* Reserva Florestal Vale da Rio Doce, São Mateus, 5–12 Jan. 1998, 1♂ (A. D. Brescovit, IBSP 16540).

Mangora lactea Mello-Leitão
Figures 638–642; Map 6E

Mangora lactea Mello-Leitão, 1944: 331, fig. 16, ♀. Female holotype from Los Talas, Prov. Buenos Aires, Argentina, in MLP no. 15965, examined. Platnick, 2006.

Description. Female from Corrientes. Prosoma yellowish. Abdomen: sprinkled with white pigment spots (Fig. 640) but without posterior black marks.. Posterior median eye row recurved. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.7 diameter. Anterior median eyes 0.8 diameter apart, 1.3 from laterals. Posterior median eyes 0.8 diameter apart, 2.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 5.8 mm. Carapace 2.2 mm long, 1.8 wide in thoracic region, 0.8 wide behind lateral eyes, 1.2 high. First femur 2.3 mm, patella and tibia 2.6, metatarsus 2.2, tarsus 0.8. Second patella and tibia 2.2 mm, third 1.6, fourth 2.6. First and fourth legs subequal in length.

Male from Prov. Buenos Aires. Color as in female. Posterior median eye row recurved. Ocular quadrangle wider than long, anterior widest. Posterior median eyes 0.8 diameter of anterior medians; lateral eyes 0.6 diameter. Anterior median eyes 1.0 diameter apart, 1.1 from laterals. Posterior median eyes 0.3 their diameter apart, 2.0 from laterals. Height of clypeus equals 1.0 diameter of anterior median eyes. Total length 3.7 mm. Carapace 1.8 mm long, 1.5 wide in thoracic region, 0.6 wide behind lateral eyes, 1.0 high. First femur 2.2 mm, patella and tibia 2.5, metatarsus 2.1, tarsus 0.8. Second patella and tibia 2.0 mm, third 1.4, fourth 2.3.

Males and females have been collected together.

Variation. Total length of females 4.8 to 6.0 mm, males 3.2 to 4.2. The epigynum usually has a mucus plug, making it difficult to examine. Figures 638, 639 were made from the female holotype, the male specimens from Buenos Aires Prov.

Diagnosis. Mangora lactea is the only large-sized *Mangora* without a pair of black patches on the posterior of the abdomen (Fig. 640). The epigynum in ventral view has two loops meeting and touching along the midline (Fig. 638), whereas in *M. itatiaia*, the loops form a tongue (Fig. 633). In posterior view, the lateral plates are separated in *M. lactea* (Fig. 639), whereas in *M. itatiaia*, they fuse dorsally embracing the long median plate (Fig. 634).

The *M. lactea* terminal apophysis of the male palpus has a projecting distal hook

(11 h in Figs. 641, 642), and the median apophysis has no spine (Fig. 642), whereas the palp of *M. itatiaia* lacks the distal hook, and the median apophysis is pointed at its distal end (Fig. 636).

Distribution. Southeastern Bolivia, southern Brazil, and northern Argentina (Map 6E).

Specimens Examined. BRAZIL *São Paulo:* Amparo, 18 Feb. 1943, 1♀, 1♂ (J. Lima, MZSP 13254). *Paraná:* Guarapuava, 28 Apr. 1967, 1♀ (P. de Biasi, MZSP 7036). *Rio Grande do Sul:* Bom Jesus, Fazenda Santa Cruz, 28–31 Mar. 1998, 1♀ (A. B. Bonaldo, MCN 29286). URUGUAY *"Kuinta y Kis" [Treinta y Tres?]:* Río Alimar Chico, 25 km WSW "Kuinta y Kis" [Treinta y Tres], 13 Apr. 1963, 1♀ (J. K. Bausiman, AMNH). BOLIVIA *Chuquisaca:* San Antonio de Parapetí, Río Parapetí, 15–25 July 1964, 1♀ (B. Malkin, AMNH). ARGENTINA *Corrientes:* Corrientes, ca. 1945, 1♀ (BMNH). *Catamarca:* El Rodeo, Jan. 1957, 1♀ (M. E. Galiano, MACN). *Córdoba:* Calamuchita, Mar. 1956, 3♀ (M. J. Viana, MACN); Jesus María, June 1944, 1♀ (Maldonado, MLP). *Entre Ríos:* Paraná, J. Catalina, 25 Feb. 1934, 8♀, 3♂ (D. Jurado, J. B. Daguerre, MACN); Parque Nacional El Palmar, Feb. 1951, 2♀ (P. Goloboff, MACN). *Buenos Aires:* Buenos Aires, Apr. 1940, 3♀ (F. Monrós, MACN); Reserva Ribera Norte, Mar. 1999, 2♀ (M. Pandolfi, MACN); Tigre, Apr. 1927, 1♀ (J. Brethes, MACN); May 1949, 1♀ (J. M. Viana, MACN); Punta Lara, Feb. 1941, 1♀ (F. Monrós, MACN); Feb. 1967, 3♀, 3 ♂ (M. E. Galiano, MACN, MCZ); Isla Martín García, 1940, 1♀ (J. M. Viana, MACN); Delta, Arroyo Caraguatá, La Violeta, 6 Feb. 1951, 1♀ (A. Bachmann, MACN 3222).

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Bulletin OF THE
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New Eleutherodactyline Frogs (Leptodactylidae: *Pristimantis*, *Phrynopus*) From Peru

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NEW ELEUTHERODACTYLINE FROGS (LEPTODACTYLIDAE: *PRISTIMANTIS, PHRYNOPUS*) FROM PERU

EDGAR LEHR[1]

Abstract. Four new species of *Pristimantis* and three new species of *Phrynopus* are described from Peru. Two of the new species of *Pristimantis* are assigned to the *orestes* species Group, one to the *conspicillatus* Group, and one to the *unistrigatus* Group. Three of the new species of *Pristimantis* were obtained from the Cordillera de Vilcabamba in southern Peru, which is known for high biological diversity and endemism. One of the new species from the Vilcabamba region belongs to the *orestes* species Group and is separated by approximately 600 km (straight-line) from proximate known species of the group (*Pristimantis cordovae*) in northern Peru. This new species is the only one of *Pristimantis* attaining an elevation of 3,350 m in southern Peru. Two of the new species of *Phrynopus* are from central Peru, lack a tympanum, and have previously been confused with *P. montium*; the third species of *Phrynopus* is described from the Departamento de Ayacucho in southern Peru. *Pristimantis pharangobates* is excluded from the synonymy of *P. rhabdolaemus* and considered to be a valid species. Currently, 126 species of eleutherodactyline frogs (*Oreobates, Pristimantis, Phrynopus,* and *Phyllonastes*) are known from Peru, representing about 30% of the Peruvian anuran fauna.

Resumen. Cuatro especies nuevas de *Pristimantis* y tres especies nuevas de *Phrynopus* se describen para Perú. Dos de las nuevas especies de *Pristimantis* se asignan al Grupo de especies *orestes,* uno al Grupo *conspicillatus,* y uno al Grupo *unistrigatus.* Tres de las nuevas especies de *Pristimantis* fueron obtenidos de la Cordillera de Vilcabamba al sur de Perú que es conocida por su alta diversidad biológica y endemismo. Una de las especies nuevas de la región de Vilcabamba pertenece al Grupo de especies *orestes* y está separada por aproximadamente 600 Km. (línea aérea) de la especie más próxima y conocida del grupo al norte de Perú (*Pristimantis cordovae*). Esta especie nueva es la única especie de *Pristimantis* que alcanza una elevación de 3,350 m al sur de Perú. Dos de las nuevas especies de *Phrynopus* son del Perú central, carecen de tímpano y han sido previamente confundidas con *P. montium*; la tercera especie de *Phrynopus* se describe para el Departamento de Ayacucho al sur de Perú. *Pristimantis pharangobates* se excluye de la sinonímia de *P. rhabdolaemus* y es considerada como especie válida. Actualmente, 126 especies de ranas eleutherodactylinas (*Oreobates, Pristimantis, Phrynopus,* y *Phyllonastes*) se conocen para Perú y representan alrededor del 30% de la fauna de anuros peruana.

INTRODUCTION

During the last decade, numerous expeditions to remote Andean regions in Peru assessed the anuran diversity in cloud forests and puna habitats. Fieldwork resulted in the discovery of 32 new species of *Pristimantis* (formerly *Eleutherodactylus*) (Duellman and Hedges, 2005; Duellman and Lehr, 2007; Duellman et al., 2006; Duellman and Pramuk, 1999; Lehr, 2005; Lehr et al., 2004a, 2006, 2007), one *Phyllonastes* (Lehr et al., 2004b), and 11 *Phrynopus* (Duellman, 2000; Lehr, 2001, 2006; Lehr and Aguilar, 2002, 2003; Lehr et al., 2000, 2002, 2005). Other publications focused on the validity of some species of *Phrynopus* and their generic assignment; this led to new combinations and synonymies (Lehr, 2005, 2006; Lehr and Aguilar, 2006; Lehr et al., 2005) and the discovery of a new genus of microhylid (Lehr, 2006). Currently, 126 species of eleutherodactyline frogs (*Oreobates, Pristimantis, Phrynopus,* and *Phyllonastes*) are known from Peru, which is about 30% of the Peruvian anuran fauna (406, updated from AmphibiaWeb, 2006).

During a research project on eleuther-

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odactyline frogs from Peru, major herpetological collections in the USA, Germany, and Peru were visited. Examination of the material revealed numerous new species, several of which have been described (Duellman and Lehr, 2007). Four new species of *Pristimantis* and three new species of *Phrynopus* are described herein.

MATERIALS AND METHODS

Taxonomy of *Eleutherodactylus* follows Heinicke et al. (2007), whose recent phylogenetic studies of *Eleutherodactylus* led to the recognition of three clades: a Caribbean clade (*Eleutherodactylus*), a Middle American clade (*Craugastor*), and a major South American clade (*Pristimantis*). Familial placement of *Phrynopus* and *Pristimantis* will be changed in the near future (Duellman, personal communication); therefore, I hesitate in following Frost et al. (2006). For general critics concerning Frost et al. (2006), see Wiens (2007), or with respect to *Eleutherodactylus,* see Duellman and Lehr (2007). Because of morphological similarities between *Phrynopus* and *Pristimantis,* the format for the description follows that of Lynch and Duellman (1997) for *Pristimantis,* except that the term "dentigerous processes of vomers" is used instead of "vomerine odontophores" (Duellman et al., 2006). Forefeet and hind feet of *Phrynopus* specimens were x-rayed to verify generic placement (terminal phalanges T-shaped in *Pristimantis* compared with knob-shaped in *Phrynopus*). I follow the definition of conditions of the tympanum by Lynch and Duellman (1997). Specimens were dissected to determine the sex and maturity, and the otic region was dissected to determine the condition of the tympanic annulus. Measurements taken with digital calipers and rounded to the nearest 0.1 mm are: snout–vent length (SVL), tibia length (TL), foot length (FL, distance from proximal margin of inner metatarsal tubercle to tip of toe IV), head length (HL, from angle of jaw to tip of snout), head width (HW, at level of angle of jaw), eye diameter (ED), tympanum diameter (TY), interorbital distance (IOD), upper eyelid width (EW), internarial distance (IND), and eye–nostril distance (E–N, straight-line distance between anterior corner of orbit and posterior margin of external nares). Comparative lengths of toes III and V were determined by adpressing both toes against toe IV; lengths of forelimb toes (fingers) I and II were determined by adpressing the fingers against each other. All drawings were made by the author with the use of a stereomicroscope with drawing tube attachment. Photographs taken by P. Lehr were used for descriptions of coloration in life. Global Gazetteer Version 2.1 (Falling Rain Genomics, Inc.) was used to georeference the locality of Rapi. Specimens collected by the author were preserved by injecting a mixture of (5:1,000) 40% formalin and 96% ethanol and were stored in 70% ethanol and deposited in the herpetological collections at the Museo de Historia Natural Universidad Nacional Mayor de San Marcos (MHNSM) in Lima, Peru, and at the Museum für Tierkunde Dresden (MTD), Germany. Codes for other museum collections are those of Leviton et al. (1985). For specimens examined, see the Appendix.

RESULTS

Pristimantis chimu sp. nov.
Map 1, Figures 1–2

Holotype. MCZ 136071 (Fig. 1), an adult female, from 2–3 km NW (straight-line) El Pargo (Llama-Huambos Road) 3,000–3,100 m, Departamento de Cajamarca, Peru, collected by J. P. Cadle on 12 August 1994.

Paratypes. Fifteen adult females (MCZ 136060–72, 136074–76), two adult males (MCZ 136073, 136077) all collected with the holotype by J. P. Cadle on 12 August 1994.

Diagnosis. A member of the *Pristimantis orestes* Group having the following combination of characters: (1) skin on dor-

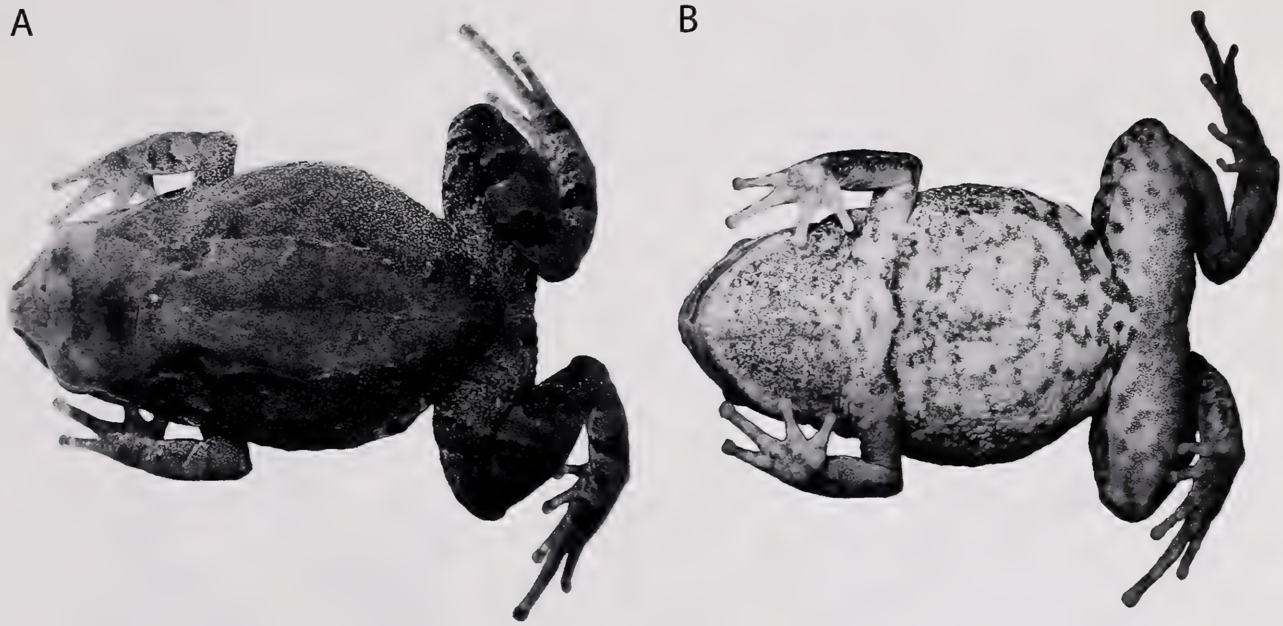


Figure 1. Dorsal (A) and ventral (B) views of *Pristimantis chimu* (MCZ 136071, holotype, SVL 24.6 mm).

sum shagreen with small scattered tubercles; weak, discontinuous dorsolateral fold present; skin on venter areolate; discoidal fold present; (2) tympanic membrane and tympanic annulus present; upper and posterolateral margin slightly concealed by supratympanic fold; (3) snout moderate, rounded in dorsal and lateral views; (4) upper eyelid with small tubercles; upper eyelid width narrower than IOD; low cranial crests present; (5) dentigerous processes of vomers prominent, ovoid, narrowly separated; each process bearing 4–7 teeth; (6) males lacking vocal sac, vocal slits, and nuptial pads; (7) finger I shorter than finger II; discs on outer fingers narrow, rounded; (8) fingers with narrow lateral fringes; (9) ulnar tubercles coalesced into short fold; tarsal tubercles present; (10) heel with small tubercles; inner tarsal fold present; (11) inner metatarsal tubercle elongate, narrow, twice the size of ovoid outer metatarsal tubercle, elevated, slightly conical in lateral view; diffuse, low supernumerary plantar tubercles present; (12) toes with narrow lateral fringes; toe webbing absent; toe V slightly longer than toe III; toe discs slightly larger than discs on fingers, rounded; (13) in ethanol, dorsum pale grayish brown with diffuse brown flecks; venter tan and dark brown mottled; groin white with dark brown blotches; iris dark gray; (14) SVL in females 22.6–25.7 mm (n = 16), in males 19.4–20.5 mm (n = 2).

Pristimantis chimu is readily distinguished from the other 12 species (except for *P. seorsus*) currently assigned to the *P. orestes* Group (Duellman et al., 2006; Lehr and Duellman, 2007; this paper) by having weakly developed cranial crests. *Pristimantis chimu* and *P. seorsus* both have low cranial crests, but *P. chimu* differs by having prominent dentigerous processes of vomers (minute in *P. seorsus*) and the tympanum distinct externally (tympanum visible beneath skin in *P. seorsus*). Three other species (*P. cordovae, P. ventriguttatus,* and *P. vidua*) of the *P. orestes* Group have dorsolateral folds and dentigerous processes of vomers. *Pristimantis chimu* differs from them by having vocal slits in males. Furthermore, *P. chimu* differs from *P. cordovae* in having finger and toe discs rounded (emarginate in *P. cordovae*), venter mottled tan and brown (brown with tan blotches and spots in *P. ventriguttatus*), and groin white with dark brown blotches (no white and dark brown). Besides *P. chimu* and *P. ventri-*

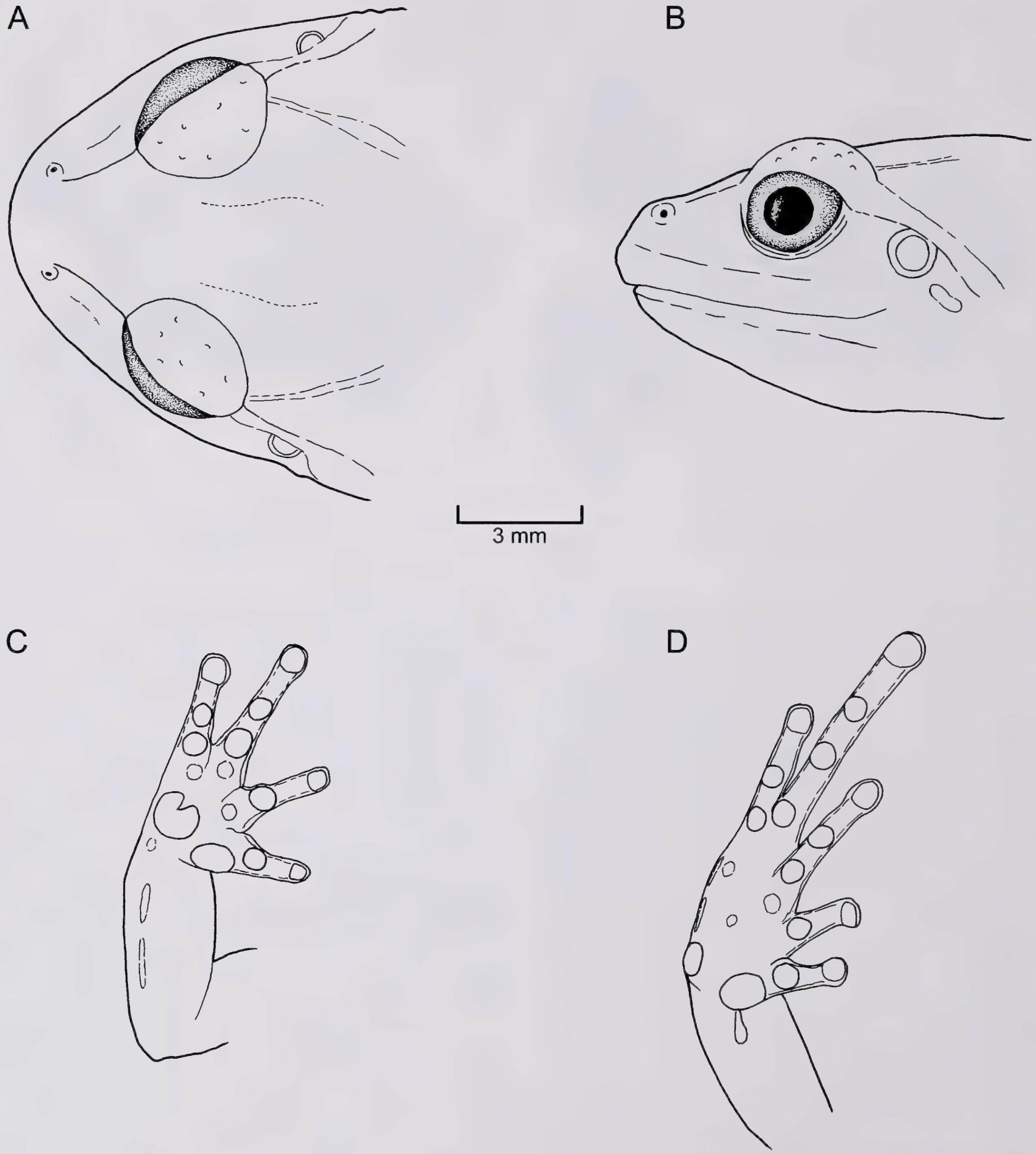
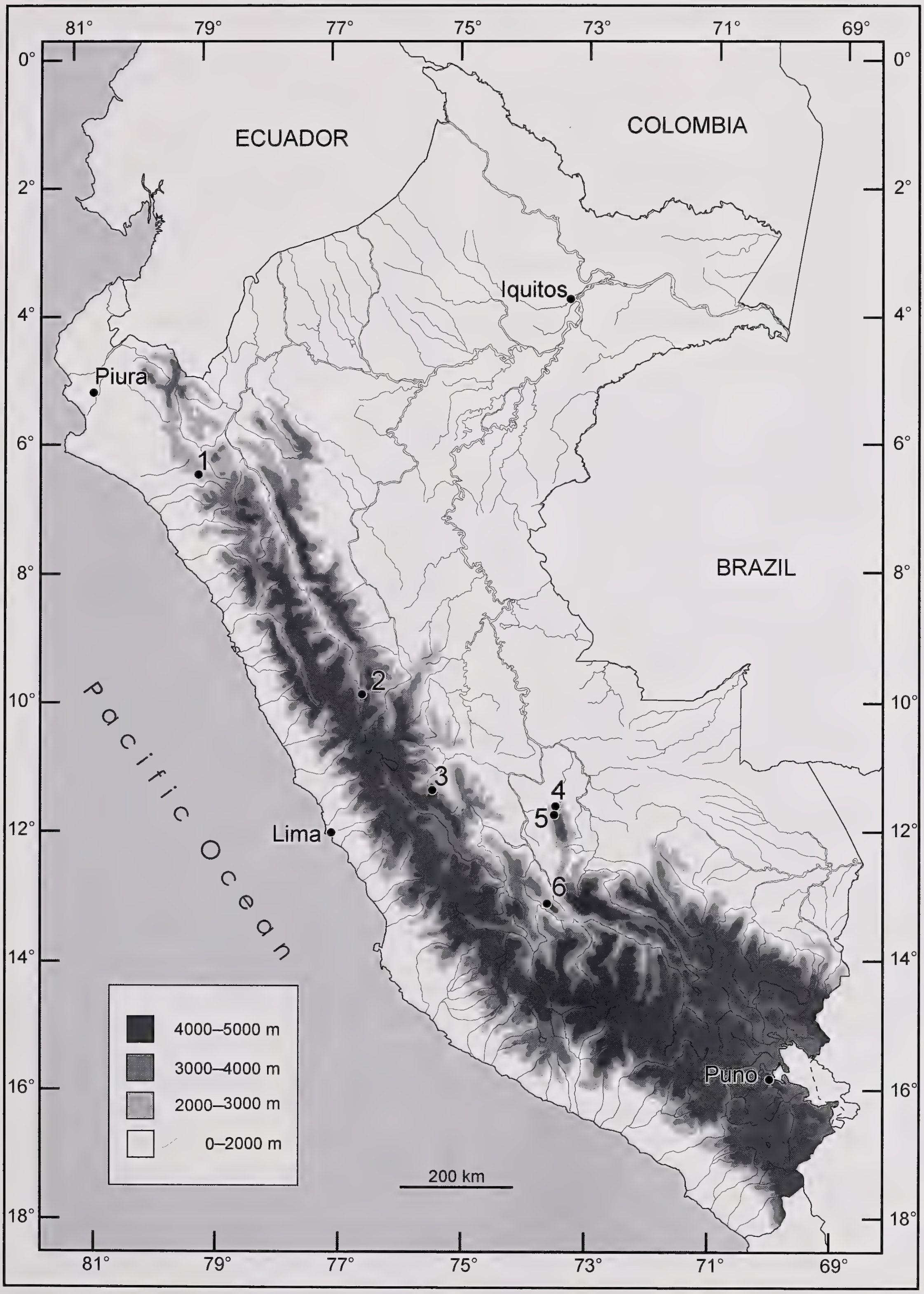


Figure 2. Dorsal (A) and lateral (B) views of head and ventral views of forefoot (C) and hind foot (D) of *Pristimantis chimu* (MCZ 136071).

guttatus, two other species of the *P. orestes* Group (*P. pinguis* and *P. simonsii*) are known from the Cordillera Occidental in Departamento de Cajamarca. *Pristimantis chimu, P. pinguis,* and *P. simonsii* are the only species of the *orestes* Group having the ulnar tubercles coalesced into a low fold. *Pristimantis chimu* differs from all in being smaller (maximum SVL to 25.7 mm vs. 29.8 mm in *P. pinguis* [Duellman and Pramuk, 1999], 33.3 mm in *P. simonsii*). Furthermore, *P. chimu* has a tympanum (absent in *P. simonsii*), discs with discernable circumferential groves (not discern-



Map 1. Type localities of the new species: 1 = *Pristimantis chimu,* 2 = *Phrynopus kotosh,* 3 = *Pristimantis oblivius,* 4 = *Pristimantis tanyrhynchus,* 5 = *Pristimantis seorsus* and *Pristimantis vilcabambae,* 6 = *Phrynopus ayacucho.* See text for further details on distribution.

able in *P. simonsii*), and narrow discs (broad in *P. pinguis*).

Description of the Holotype. Head slightly narrower than body and slightly wider than long; head width 37.4% of SVL; head length 33.3% of SVL; low cranial crest along lateral and posterior edges of frontoparietal; snout moderate, rounded in dorsal and lateral views (Figs. 2A, B); eye diameter 109.1% of eye–nostril distance; nostrils slightly protuberant, directed laterally; canthus rostralis nearly straight in dorsal view, angular in profile; loreal region weakly concave; lips rounded; upper eyelid bearing small tubercles; upper eyelid width 64.5% of IOD; weak postocular folds present; narrow, long supratympanic fold extending from posterior edge of upper eyelid diagonally to insertion of forelimb; tympanic annulus round, its upper and posterolateral part obscured by supratympanic fold, tympanum diameter 37.5% of eye diameter, tympanum–eye distance about 1.5× tympanum diameter; postrictal tubercles coalesced into a short ridge on both sides of head. Choanae small, ovoid, not concealed by palatal shelf of maxilla; dentigerous processes of vomers prominent, ovoid, narrowly separated medially, situated posteromedial to choanae, each process bearing approximately 10 teeth in a clump; tongue 1.8× as long as wide (7.2 mm long; 4.0 mm wide), slightly notched posteriorly, posterior two-thirds free.

Skin on dorsum shagreen with small scattered tubercles, more densely at its posterior end; weak dorsolateral fold present, discontinuous toward its posterior end; skin on flanks tuberculate, tubercles coalesced into an irregularly shaped ridge on each side of body extending from area above forelimb insertion to mid of body; skin on thighs, belly, chest, and throat areolate, skin on other ventral surfaces smooth; discoidal fold weak, more prominent as thoracic fold; cloacal sheath short; cloacal region laterally and ventrally encircled by slightly larger tubercles. Ulnar tubercles coalesced into slightly discontinuous fold, covering two-thirds of outer edge of each forelimb; palmar tubercles low, outer palmar tubercle bifid, approximately 2× the size of ovoid, inner palmar tubercle; subarticular tubercles well defined, round in ventral and lateral views; supernumerary tubercles at base of fingers round, low, approximately half size of subarticular tubercles; fingers with weak lateral fringes, most prominent on basis of fingers; finger I shorter than finger II; discs on fingers narrow, slightly larger than digit proximal to it; discs round weakly truncate; ventral pads of fingers well defined by circumferential grooves (Fig. 2C).

Hind limbs relatively short, tibia length 37.0% of SVL; foot length 37.0% of SVL; upper and posterior surfaces of hind limbs tuberculate; anterior and ventral surfaces of thighs areolate; no distinct tubercles on heel or on outer surface of tarsus; short tuberclelike tarsal fold; inner metatarsal tubercle elevated, ovoid, twice the size of ovoid outer metatarsal tubercle; few, diffuse plantar supernumerary tubercles; subarticular tubercles well defined, round in ventral view, subconical in lateral view; toes with narrow lateral fringes; outer surface of both feet with a discontinuous ridge; basal webbing absent; discs about equal to those on fingers, most prominent on toe IV; discs round, weakly truncate; toes having ventral pads well defined by circumferential grooves; relative lengths of toes: 1 < 2 < 3 < 5 < 4 (Fig. 2D); toe V slightly longer than toe III (disc on toe III and on toe V not reaching distal subarticular tubercle on toe IV).

Measurements (in mm) of holotype: SVL 24.6; tibia length 9.1; foot length 9.1; head length 8.2; head width 9.2; eye diameter 2.4; tympanum diameter 0.9; IOD 3.1; upper eyelid width 2.0; internarial distance 2.1; eye–nostril distance 2.2.

Coloration of Holotype in Preservative. Dorsum grayish brown; head dorsally pale gray with an irregularly shaped dark brown interorbital stripe; dorsolateral folds pale gray; lower forelimb with diffuse dark brown blotches; hind limbs with three in-

TABLE 1. MEASUREMENTS (MM) AND PROPORTIONS OF ADULT *PRISTIMANTIS CHIMU* AND *P. SEORSUS*; RANGE (MEAN ± 1 SD).

Character	*P. chimu* Females (*n* = 16)		*P. chimu* Males (*n* = 2)		*P. seorsus* Female (*n* = 1)	*P. seorsus* Males (*n* = 3)	
SVL	22.6–25.7	(24.4 ± 0.9)	19.4–20.5	(20.0 ± 0.5)	20.9	17.6–19.4	(18.4 ± 0.8)
TL	9.1–9.9	(9.5 ± 0.2)	8.0–9.1	(8.6 ± 0.5)	9.1	7.9–8.0	(7.9 ± 0.0)
FL	8.8–10.0	(9.4 ± 0.4)	7.1–8.1	(7.6 ± 0.5)	9.3	7.8–8.4	(8.1 ± 0.2)
HL	8.1–10.2	(9.1 ± 0.6)	7.5–8.2	(7.9 ± 0.4)	8.3	7.0–7.7	(7.4 ± 0.3)
HW	8.8–10.7	(9.6 ± 0.5)	7.5–8.1	(7.8 ± 0.3)	9.1	7.3–7.6	(7.5 ± 0.1)
ED	2.0–2.5	(2.3 ± 0.2)	1.9–2.2	(2.1 ± 0.2)	2.2	1.9–2.0	(2.0 ± 0.0)
TY	0.8–1.3	(1.0 ± 0.1)	0.8–0.9	(0.9 ± 0.0)	—	—	
IOD	2.8–3.4	(3.0 ± 0.2)	2.5–2.6	(2.6 ± 0.1)	2.7	2.3–2.8	(2.5 ± 0.2)
EW	1.7–2.1	(2.0 ± 0.1)	1.8–1.8	(1.8 ± 0.0)	1.9	1.5–2.0	(1.7 ± 0.2)
IND	2.0–2.4	(2.2 ± 0.1)	1.8–1.9	(1.9 ± 0.0)	1.9	1.7–1.9	(1.8 ± 0.1)
E–N	2.0–2.4	(2.2 ± 0.1)	1.9–2.1	(2.0 ± 0.1)	2.3	1.8–1.9	(1.9 ± 0.0)
TL/SVL	0.37–0.42		0.41–0.44		0.44	0.41–0.45	
FL/SVL	0.37–0.41		0.37–0.40		0.44	0.43–0.47	
HL/SVL	0.33–0.40		0.39–0.40		0.40	0.40–0.41	
HW/SVL	0.37–0.42		0.39–0.40		0.44	0.39–0.41	
HW/HL	1.00–1.12		0.99–1.00		1.10	0.99–1.04	
E–N/ED	0.84–1.05		0.95–1.00		1.05	0.95	
EW/IOD	0.59–0.71		0.69–0.72		0.70	0.54–0.87	
TY/ED	0.38–0.57		0.41–0.42		—	—	

distinct, irregularly shaped dark brown transverse bars; dark brown canthal stripe; dark brown supratympanic fold bordered with a white stripe on each side; flanks colored as dorsum; axilla white; groin and anterior surfaces of thighs white with dark brown blotches; posterior surfaces of thighs brown with diffuse white mottling; concealed surface of shank, and inner half of tarsus white with dark brown blotches; ventral surfaces tan and brown mottled; iris dark gray.

Coloration of Holotype in Life. Unknown.

Variation. Dorsal coloration varies from gray to dark brown or gray with dark brown blotches. Six specimens (MCZ 136060, 136062–64, 136066–67) have narrow, tan middorsal stripes and a longitudinal tan stripe on the posterior surface of thighs. The coloration consisting of white and dark brown blotches in the groin is variable. Fifteen specimens have a white groin with dark brown blotches, whereas three specimens (MCZ 136064, 136074, 136076) have a dark brown groin with white blotches. All specimens have the ulnar tubercles coalesced into a fold. Dentigerous processes of vomers bear 5–10 teeth each. All specimens have low cranial crests; these are best developed in two females (MCZ 136071, 136075). See Table 1 for measurements and proportions.

Etymology. The specific name *chimu* refers to the pre-Colombian culture Chimú (A.D. 1250–1470); the Chimú people inhabited coastal areas and regions in the Cordillera Occidental in northern Peru.

Distribution and Ecology. Pristimantis chimu is known only from the type locality (Map 1). Nothing is known about its ecology.

Pristimantis seorsus sp. nov.
Map 1, Figures 3–4

Holotype. AMNH 153054 (Fig. 3), an adult female, from Cordillera de Vilcabamba, CI/RAP Expedition Camp One (11°39′36″S, 73°40′22″), 3,350 m, Provincia de Satipo, Departamento de Junín, Peru, collected by L. O. Rodríguez on 10 June 1997.

Paratypes. One female (AMNH 153055), two adult males (AMNH 153052–53) all col-

Figure 3. Dorsal (A) and ventral (B) views of *Pristimantis seorsus* (AMNH 153054, holotype, SVL 20.9 mm).

lected with the holotype by L. O. Rodríguez on 10 June 1997.

Diagnosis. A member of the *P. orestes* Group having the following combination of characters: (1) skin on dorsum shagreen with small tubercles; dorsolateral ridges forming discontinuous dorsolateral fold; skin on venter coarsely areolate; weak discoidal fold present; (2) tympanic membrane absent, tympanic annulus visible beneath skin; (3) snout moderate, with a horizontal keel at its tip; snout broadly rounded in dorsal view, rounded in lateral view; (4) upper eyelid with a short, longitudinal ridge at its posterior end contacting discontinuous dorsolateral fold; upper eyelid width narrower than IOD; low cranial crests present; (5) dentigerous processes of vomers minute, oblique, embedded in mucosa of mouth; (6) males with small vocal sac; vocal slits and nuptial pads absent; (7) finger I shorter than finger II; discs on outer fingers narrow, truncate; (8) fingers with broad lateral fringes; (9) ulnar with tubercles or short fold; outer tarsal tubercles forming ridges; (10) heel with a conical tubercle; long, inner tarsal fold present; (11) inner metatarsal tubercle ovoid, six times the size of elongate, narrow outer metatarsal tubercle; distinct supernumerary plantar tubercles present; (12) toes with broad lateral fringes; basal toe webbing present; toe V slightly longer than toe III; toe discs narrow, truncate, about the same size as discs on fingers; (13) in ethanol, dorsum pale grayish brown and dark gray mottled; venter tan and gray mottled; groin black with white blotches; (14) SVL in single female 20.9 mm, in males 17.6–19.4 mm ($n = 3$).

Pristimantis seorsus is the only species of *Pristimantis* currently known to occur above an elevation of 3,000 m in southern Peru. It is the southernmost member of the *P. orestes* Group and the only one known from the Cordillera Oriental; it is separated by approximately 600 km (straight-line) from proximate known species of the group (*Pristimantis cordovae*) in northern Peru. *Pristimantis seorsus* differs from all other members of the *P. orestes* Group in having a horizontal keel on the tip of the snout, a short, longitudinal ridge at the posterior end of the upper eyelid continuous with the dorsolateral fold, low cranial crests (except for *P. chimu*), and black groin with white blotches and black surfaces of posterior thighs and concealed surfaces of shanks. Four other species of the *P. orestes* Group have dorsolateral folds and dentigerous processes of vomers; these are *P. chimu, P. cordovae, P. ventriguttatus,* and *P. vidua. Pristimantis seorsus* differs from all of these, except

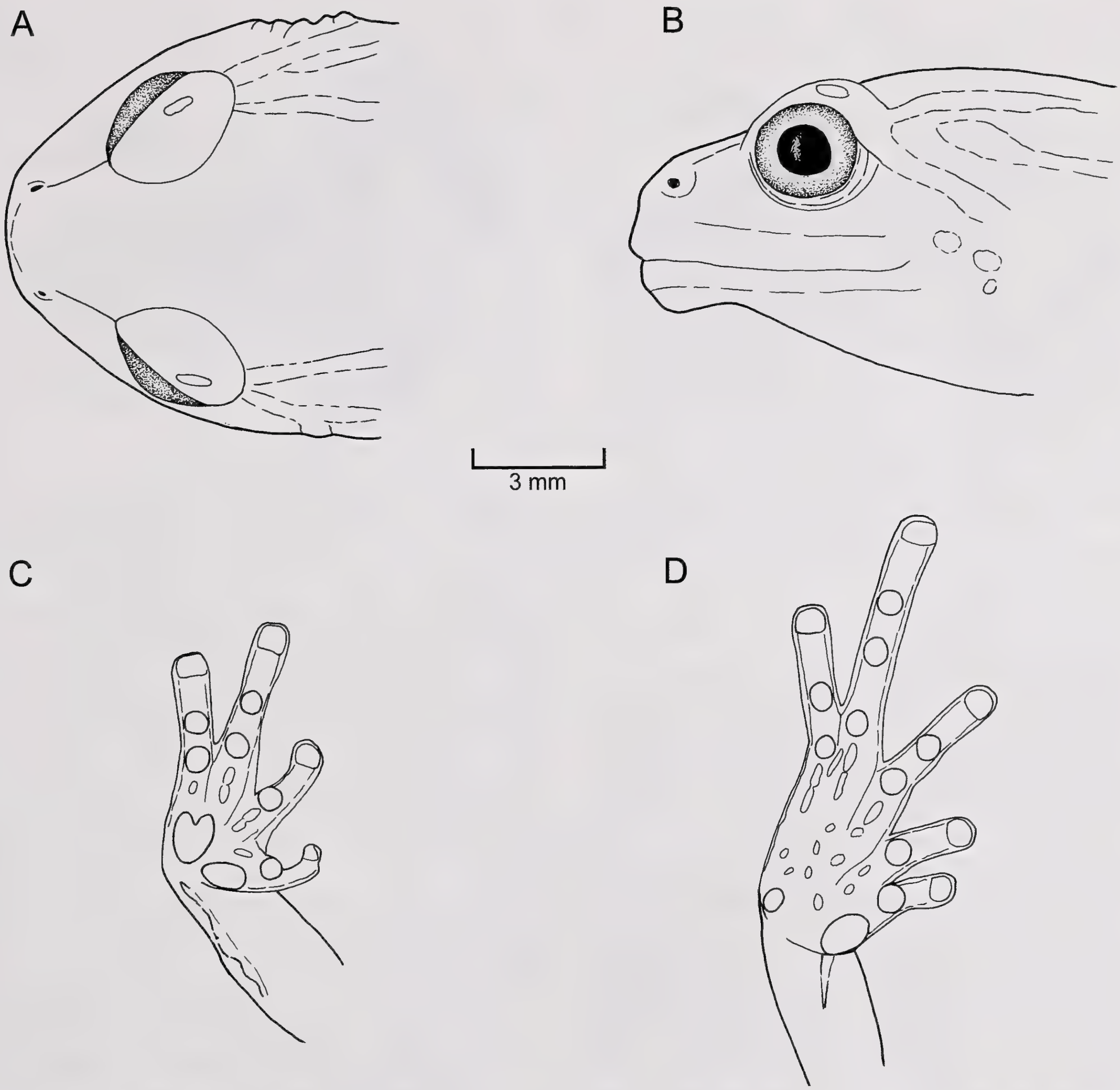


Figure 4. Dorsal (A) and lateral (B) views of head and ventral views of forefoot (C) and hind foot (D) of *Pristimantis seorsus* (AMNH 153054).

P. chimu, by males lacking vocal slits. *Pristimantis seorsus* and *P. chimu* both have low cranial crests, but *P. seorsus* differs by having minute dentigerous processes of vomers (prominent in *P. chimu*), and the tympanum visible beneath skin (tympanum distinct externally in *P. chimu*). *Pristimantis seorsus* shares with *P. chimu*, *P. pinguis*, and *P. simonsii* the presence of a low ulnar fold. *Pristimantis seorsus* differs from all of these by being smaller (SVL to 20.9 mm vs. 25.7 mm in *P. chimu*, 29.8 mm in *P. pinguis* [Duellman and Pramuk, 1999], 33.3 mm in *P. simonsii*).

Description of the Holotype. Head as broad as body, wider than long; head width 43.5% of SVL; head length 39.7% of SVL; low cranial crests present laterally on frontoparietal; snout moderate with a horizontal keel at its terminal end; snout broadly rounded in dorsal view, rounded in lateral view (Figs. 4A, B); eye diameter 95.7% of eye–nostril distance; nostrils slightly protuberant, directed laterally; canthus ros-

tralis straight in dorsal view, angular in profile; loreal region concave; lips rounded; upper eyelid bearing short, longitudinal ridge at its posterior end contacting dorsolateral fold; upper eyelid width 70.4% of IOD; narrow, long supratympanic fold extending from posterior edge of upper eyelid diagonally to insertion of forelimb; tympanic annulus visible beneath skin; two enlarged, conical postrictal tubercles present on both sides of head. Choanae small, ovoid, not concealed by palatal shelf of maxilla; dentigerous processes of vomers minute, oblique, narrowly separated medially, embedded in mucosa of mouth posteromedial to choanae; tongue 1.3× as long as wide (5.2 mm long; 3.9 mm wide), slightly notched posteriorly, posterior half free.

Skin on dorsum shagreen with small tubercles; dorsolateral ridges forming discontinuous dorsolateral fold; skin on flanks tuberculate, tubercles coalesced into a irregularly shaped ridge on each side of body extending from area above forelimb insertion to mid of body; skin on belly and thighs coarsely areolate, skin on other ventral surfaces weakly areolate; discoidal fold weak, more prominent as thoracic fold; cloacal sheath short; distinct tubercles in cloacal region absent. Ulnar tubercles coalesced into slightly discontinuous fold (more continuous on left forelimb) covering two-thirds of outer edge of each forelimb; palmar tubercles low, outer palmar tubercle bifid, approximately 2× the size of ovoid, inner palmar tubercle; subarticular tubercles well defined, round in ventral and lateral views; supernumerary palmar tubercles elongate, coalesced to short ridges, approximately one-third the size of subarticular tubercles; fingers with broad lateral fringes, most prominent basally between fingers; outer fringe of finger IV continuing to proximal edge of palm; finger I shorter than finger II; discs on fingers narrow, slightly larger than digit proximal to it; discs weakly truncate; ventral pads of fingers with weak circumferential grooves (Fig. 4C).

Hind limbs slender, tibia length 43.5% of SVL; foot length 44.5% of SVL; upper and posterior surfaces of hind limbs tuberculate; anterior surfaces of thighs weakly areolate, posterior surfaces areolate; one enlarged, conical tubercle on heel; outer surface of tarsus with a long ridge; tarsal fold long, covering two-thirds of tarsus; inner metatarsal tubercle ovoid, six times the size of elongate, narrow outer metatarsal tubercle; subarticular tubercles well defined, round in ventral view, subconical in lateral view; plantar supernumerary tubercles distinct, ovoid or coalesced to short ridges; toes with broad lateral fringes; outer fringe of toe V continuing to proximal edge of plantar; basal webbing present; discs about equal to those on fingers; discs truncate; toes having ventral pads weakly defined by circumferential grooves; relative lengths of toes: $1 < 2 < 3 < 5 < 4$ (Fig. 4D); toe V slightly longer than toe III (disc on toe III and on toe V not reaching distal subarticular tubercle on toe IV).

Measurements (in mm) of holotype: SVL 20.9; tibia length 9.1; foot length 9.3; head length 8.3; head width 9.1; eye diameter 2.2; IOD 2.7; upper eyelid width 1.9; internarial distance 1.9; eye–nostril distance 2.3.

Coloration of Holotype in Preservative. Dorsum pale grayish brown and dark gray mottled; forefeet and hind feet cream; inner fingers (I–III) and inner toes (I–III) predominately cream, outer fingers and toes colored as dorsum; forelimbs and hindlimbs colored as dorsum without bars; diffuse, grayish-brown canthal stripe present; upper lip tan without bars; supratympanic stripe absent; flanks colored as dorsum; axilla black; left groin black, right groin black with a white and a pale pink blotch; anterior surfaces of thighs black; posterior surfaces of thighs and concealed surfaces of shank black; throat tan and brown mottled; chest, belly, and thighs tan and gray mottled; forefeet cream; hind feet tan and gray mottled; iris dark gray.

Coloration of Holotype in Life. Unknown.

Figure 5. Dorsal (A) and ventral (B) views of *Pristimantis tanyrhynchus* (AMNH 153049, holotype, SVL 31.4 mm).

Variation. All specimens are colored like the holotype. Coloration of the groin varies in the amount of black ground color and white or pink blotches. In two of the paratypes (AMNH 153052, 153055) the blotches in the groin are pale pink, indicating that they may have been red in life. See Table 1 for measurements and proportions.

Etymology. The specific name *seorsus* is a Latin adjective meaning apart, separate. It refers to the disjunct distribution of this species with other members of the *P. orestes* Group.

Distribution and Ecology. Pristimantis seorsus is known only from the type locality (Map 1). Nothing is known about its ecology. Vegetation at the type locality consisting of pajonales, mixed-species forest, and *Polylepis* forest and was described in detail by Boyle (2001). The herpetofaunal diversity (mostly unidentified at the species level) was described by Rodríguez (2001) and Rodríguez and Rivera (2001).

Pristimantis tanyrhynchus sp. nov.
Map 1, Figures 5–6

Holotype. AMNH 153049 (Fig. 5), an adult female from Cordillera de Vilcabamba, CI/RAP Expedition Camp Two (11°33′35″S, 73°38′28″W), 2,050 m, Provincia de Satipo, Departamento de Junín, Peru, collected by L. O. Rodríguez on 26 June 1997.

Paratypes. Four males (AMNH 153047–48 obtained on 22 June 1997, AMNH 153050 obtained on 23 June 1997, AMNH 153051 obtained on 23 June 1997), all collected at the type locality by L. O. Rodríguez.

Diagnosis. A member of the *Pristimantis conspicillatus* Group having the following combination of characters: (1) skin on dorsum shagreen; prominent dorsolateral fold present; skin on venter coarsely areolate; discoidal fold present; (2) tympanic annulus and membrane present; (3) snout long, subacuminate in dorsal view, protruding in lateral view; (4) upper eyelid without tubercles; upper eyelid width much narrower than IOD; cranial crests absent; (5) dentigerous processes of vomers absent; (6) males with vocal sac, vocal slits, and nuptial pads; (7) finger I shorter than finger II; discs on outer fingers broad, truncate; (8) fingers with lateral fringes; (9) outer surfaces of ulnar and tarsus with a long fold; (10) heel with a large, conical tubercle; short, inner tarsal fold present; (11) inner metatarsal tubercle ovoid, four times the size of ovoid outer metatarsal tubercle; distinct supernumerary plantar tubercles present; (12) toes with lateral fringes; basal toe webbing pres-

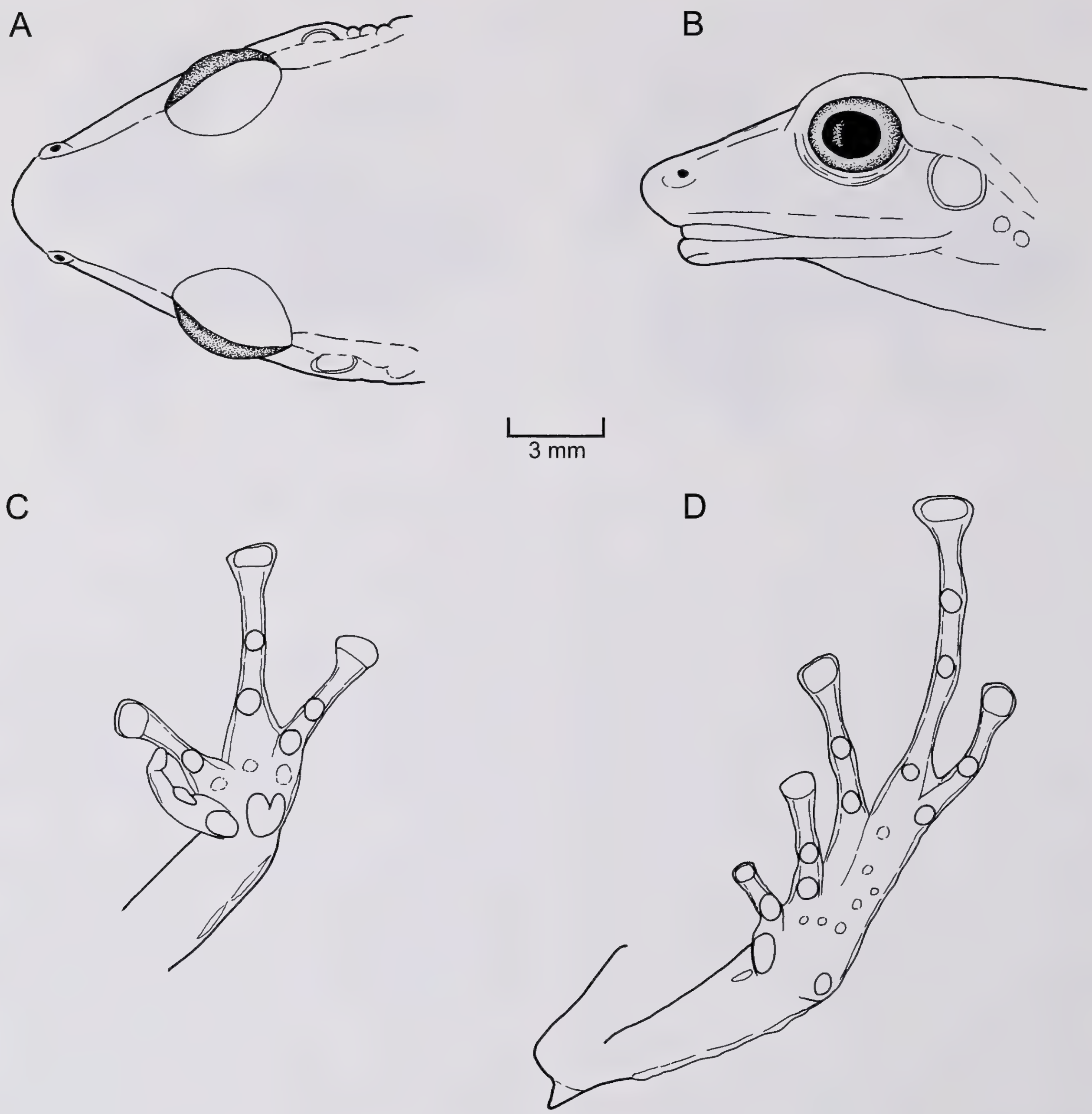


Figure 6. Dorsal (A) and lateral (B) views of head and ventral views of forefoot (C) and hind foot (D) of *Pristimantis tanyrhynchus* (AMNH 153049).

ent; toe V slightly longer than toe III; toe discs broad, truncate, about the same size as discs on fingers; (13) in ethanol, dorsum brown with dark brown interorbital bar and dark brown chevrons; venter tan with dark brown flecks more dense on throat; (14) SVL in single female 31.4 mm, in four males 20.8–23.6 mm.

Pristimantis tanyrhynchus (*Eleutherodactylus* cf. *rhabdolaemus* according to Rodríguez [2001] and Rodríguez and Rivera [2001]) differs from other members of the *P. conspicillatus* Group in having a long, protruding snout with nearly vertical sides; large conical heel tubercles; prominent dorsolateral folds; and dentigerous processes of vomers absent. *Pristimantis tanyrhynchus* is like *P. lanthanites* in having conical tubercles on the heels, but it is smaller than *P. lanthanites* (SVL 31.4 mm vs. 45.4 mm), has a coarsely areolate venter (smooth in *P. lanthanites*), lacks den-

Figure 7. Dorsal views of (A) *Pristimantis rhabdolaemus* (KU 175083, SVL 28.9 mm, female) and (B) *P. pharangobates* (KU 173246, SVL 26.1 mm, female).

tigerous processes of vomers (prominent in *P. lanthanites*), and has a dark brown throat with cream blotches and usually two cream midventral stripes (dark brown with single white midventral stripe in *P. lanthanites*). Furthermore, *P. tanyrhynchus* is known from the eastern Andes in southern Peru at an elevation of 2,050 m, whereas *P. lanthanites* is known from the Amazon Basin from northern Peru to southern Colombia from elevations of 1,500 m in the Andes of northern Peru and Ecuador. Among other Andean members of the *P. conspicillatus* Group with relatively long snouts and a dorsal pattern consisting of dark brown chevrons on the back, *P. tanyrhynchus* is most similar to *P. rhabdolaemus.* Lynch and McDiarmid (1987) synonymized *P. pharangobates* with *P. rhabdolaemus. Pristimantis pharangobates* and *P. rhabdolaemus* are superficially similar, but differ in size of scapular tubercles, shape of snout, size of heel tubercles, shape of subarticular tubercles, and shape of dorsal chevrons (Fig. 7, Table 2). Herein I recognize *P. pharangobates* as a distinct species. Although not mentioned in the original descriptions, both species have fingers and toes with narrow lateral fringes.

Pristimantis tanyrhynchus differs from *P. rhabdolaemus* by the following characters (characters for *P. rhabdolaemus* in parentheses, also see Table 2): males have

TABLE 2. SELECTED CHARACTERS AND CHARACTER CONDITIONS OF *PRISTIMANTIS* SPECIES SIMILAR TO *P. TANYRHYNCHUS*. INFORMATION WAS TAKEN FROM ORIGINAL SPECIES DESCRIPTIONS (DUELLMAN, 1978A, B; LEHR ET AL., 2006; LYNCH, 1975) AND SPECIMENS EXAMINED.

Character	*P. tanyrhynchus*	*P. lanthanites*	*P. ornatus*	*P. pharangobates*	*P. rhabdolaemus*
SVL females (mm)	31.4	27.5–45.4	20.7–27.3	27.8–29.5	28.6–31.7
SVL males (mm)	20.8–23.6	21.7–27.9	16.7–20.5	21.4–25.4	21.3–24.0
Skin on dorsum	shagreen	finely tuberculate with scattered larger tubercles	finely shagreen with small scattered tubercles	shagreen	shagreen
Skin on venter	coarsely areolate	smooth	smooth	areolate	areolate
Dorsolateral folds	present	present	present	present	present
Male characters present	vocal slits, vocal sac, nuptial pads	vocal slits, nuptial pads	vocal slits	vocal slits, vocal sac	vocal slits, vocal sac
Shape of snout	subacuminate in dorsal view, protruding in lateral view	subacuminate in dorsal view, rounded in lateral view	subacuminate in dorsal view, rounded in lateral view	acuminate in dorsal view, rounded in lateral view	narrowly rounded in dorsal view, rounded in lateral view
Dentigerous processes of vomers	absent	present (prominent, oblique)	present (small, oblique)	present (small, oblique) or absent	present (small, oblique)
Inner tarsal folds	present	absent	absent	present	present
Heel tubercles	present (large, conical)	present (moderate, conical)	absent	present (small, low: broader than high)	present (small, distinct: higher than broad)
Lateral fringes	present	absent	absent	present	present
Supernumerary plantar tubercles	many, diffuse	few, distinct	few, distinct	few, distinct	many, diffuse
Subarticular tubercles on toes	subconical in lateral view	conical in lateral view	subconical in lateral view	low, round in lateral view	conical in lateral view
Scapular tubercles	absent	present (large)	absent	present (small) or indistinct	present (large)
Dorsal pattern	chevrons broad	chevrons broad, difficult to distinguish from surrounding pattern	chevrons interrupted, "washed out"	chevrons narrow	chevrons broad
Coloration of throat	cream and dark brown mottled with two midventral cream stripes	gray with white flecks and a broad medial white stripe	whitish gray with grayish-brown blotches	cream with dark brown streaks	cream with dark brown streaks

weak nuptial pads on thumb (absent); snout long, subacuminate in dorsal view, protruding in lateral view, its sides nearly vertical (snout slightly shorter, narrowly rounded in dorsal view, rounded in lateral view, its sides diagonal); dentigerous processes of vomers absent (present), heel tubercles large, conical (small, rounded); subarticular tubercles subconical (conical); scapular tubercles absent (present). *Pristimantis tanyrhynchus* differs from *P. pharangobates* by males having weak nuptial pads (absent); the snout protruding in lateral view (rounded); dentigerous processes of vomers absent (usually present); large, conical tubercles on heels (small, low); chevrons on back broad (narrow); scapular tubercles absent (present). *Pristimantis tanyrhynchus* differs from *P. ornatus* in being larger (SVL to 31.4 mm vs. 27.3 mm in *P. ornatus*), in having a coarsely areolate venter (smooth in *P. ornatus*), and in having an inner tarsal fold (absent in *P. ornatus*).

Description of the Holotype. Head narrower than body, longer than wide; head width 31.8% of SVL; head length 37.6% of SVL; cranial crests absent; snout long with its sides nearly vertical, subacuminate in dorsal view, protruding well anteriad to margin of lower jaw in lateral view (Figs. 6A, B); eye diameter 76.2% of eye–nostril distance; nostrils posteriorly slightly protuberant, directed laterally and protruding beyond upper jaw in dorsal view; canthus rostralis sharp, straight in dorsal view, angular in profile; loreal region concave; lips rounded; upper eyelid without tubercles, width 52.4% of IOD; narrow, weak supratympanic fold extending from posterior edge of upper eyelid diagonally to insertion of forelimb; tympanic annulus and membrane present, its upper and posterior margin concealed by supratympanic fold; two enlarged, conical postrictal tubercles present on both sides of head. Choanae small, triangular, not concealed by palatal shelf of maxilla; dentigerous processes of vomers absent; tongue 1.2× as long as wide (5.9 mm long; 4.8 mm wide), slightly notched posteriorly, posterior one-third free.

Skin on dorsum shagreen with small tubercles on posterior half of body; long dorsolateral folds present toward its end, more like a row of tubercles; skin on flanks tuberculate; skin on belly and thighs coarsely areolate; skin on other ventral surfaces weakly areolate; discoidal fold prominent; cloacal sheath short; distinct tubercles in cloacal region absent. Ulnar tubercles forming discontinuous fold on outer edge of left forelimb, on right forelimb three low, elongate tubercles present; palmar tubercles low, outer palmar tubercle bifid, approximately 3× the size of ovoid, inner palmar tubercle; subarticular tubercles well defined, ovoid in ventral view, subconical in lateral view; few supernumerary palmar tubercles, ovoid, low, approximately half size of subarticular tubercles; fingers with lateral fringes, most prominent basally between fingers; outer fringe of finger IV continuing to mid of outer edge of palm; finger I shorter than finger II; discs on fingers broadly expanded, approximately 3× the size of digit proximal to it, most prominent on finger III and IV; discs truncate; ventral pads of fingers well defined by circumferential grooves (Fig. 6C).

Hind limbs long, slender, tibia length 58.0% of SVL; foot length 50.3% of SVL; upper surfaces of hind limbs shagreen with small tubercles; anterior surfaces of thighs smooth, posterior surfaces weakly areolate; heel with small tubercles and one large, conical tubercle; outer surface of tarsus with a long, discontinuous ridge; inner tarsal fold short, tuberclelike; inner metatarsal tubercle ovoid, four times the size of round outer metatarsal tubercle; subarticular tubercles well defined, ovoid in ventral view, subconical in lateral view; plantar supernumerary tubercles many, diffuse; toes with broad lateral fringes; outer fringe of toe V continuing to proximal edge of plantar; basal webbing present, most prominent between toes IV and V; discs slightly smaller than those on fin-

gers; discs truncate; toes having ventral pads well defined by circumferential grooves; relative lengths of toes: 1 < 2 < 3 < 5 < 4 (Fig. 6D); toe V slightly longer than toe III (disc on toe III and on toe V not reaching distal subarticular tubercle on toe IV).

Measurements (in mm) of holotype: SVL 31.4; tibia length 18.2; foot length 15.8; head length 11.8; head width 10.0; eye diameter 3.2; tympanum diameter 1.5; IOD 4.2; upper eyelid width 2.2; internarial distance 3.0; eye–nostril distance 4.2.

Coloration of Holotype in Preservative. Dorsum brown with three dark brown blotches on snout, narrow dark brown interorbital bar, one broad, dark brown chevron on scapula and a second on back followed by single dark brown blotch and an interrupted chevron on posterior end of body, all dark brown chevrons/blotches surrounded with narrow tan lines; forelimbs tan with two brown bars on lower forelimb; forefeet tan; upper and lower limbs tan, each with three narrow brown bars; dark brown canthal and supratympanic stripe present; upper lip tan without bars, its lower margin dark brown; sides of head grayish tan; flanks colored as dorsum with three brown diagonal stripes; groin cream bordered above with dark brown flecks; upper half of anterior surfaces of thighs grayish tan, its lower half cream, both separated by a dark brown longitudinal stripe; posterior surfaces of thighs brown with cream spots and flecks; concealed surfaces of shanks colored as anterior surface of thighs; throat dark brown with cream flecks and two midventral stripes, ventral surface of lower jaw dark brown with cream spots; chest cream with dark brown flecks, belly, forelimbs, and hindlimbs cream with dark brown flecks; hind feet and forefeet grayish brown; iris dark gray.

Coloration of Holotype in Life. Unknown.

Variation. All specimens have a large conical tubercle on the heel. One specimen (AMNH 153050) has cream dorsolateral folds. Two specimens (AMNH 153047, 153051) are tan with gray chevrons, bars, and blotches. One specimen (AMNH 153048) has a tan dorsum mottled with gray and no evident chevrons. Three specimens (AMNH 153048–50) have dark brown throats with cream blotches, two large, cream blotches on chin and two midventral cream stripes, whereas two (AMNH 153047, 153051) have ventral surfaces predominately tan with throat pattern barely visible. See Table 3 for measurements and proportions.

Etymology. The specific name *tanyrhynchus* is derived from the Greek adjective *tany* meaning long and the Greek noun *rhynchos* meaning snout; *rhynchus* is the Latinized noun. The name refers to the long snout of this species.

Distribution and Ecology. Pristimantis tanyrhynchus is known only from the type locality (Map 1). Nothing is known about its ecology. Vegetation at Camp Two consists of tall cloud forest (18–20 m) with a high number of epiphytes, terrestrial Araceae, ferns, and orchids (Rodríguez, 2001). For comments on herpetofaunal diversity, see paragraph on distribution and ecology of *P. seorsus.*

Pristimantis vilcabambae sp. nov.
Map 1, Figures 8–9

Holotype. AMNH 153057 (Fig. 8), an adult female, from Cordillera de Vilcabamba, CI/RAP Expedition Camp Two (11°33′35″S, 73°38′28″W), 2,050 m, Provincia de Satipo, Departamento de Junín, Peru, collected by L. O. Rodríguez on 24 June 1997.

Paratypes. Three males (AMNH 153058–60, obtained on 21 June 1997), one juvenile (AMNH 1530613, obtained on 22 June 1997), all collected with the holotype by L. O. Rodríguez 1997.

Diagnosis. A member of the *Pristimantis unistrigatus* Group having the following combination of characters: (1) skin on dorsum shagreen with few conical tubercles; dorsolateral fold absent; skin on venter areolate; weak discoidal fold present; (2)

Table 3. Measurements (mm) and proportions of adult *Pristimantis tanyrhynchus* and *P. vilcabambae*; range (mean ± 1 SD).

Character	*P. tanyrhynchus* Female (n = 1)	*P. tanyrhynchus* Males (n = 4)		*P. vilcabambae* Female (n = 1)	*P. vilcabambae* Males (n = 3)	
SVL	31.4	20.8–23.6	(21.9 ± 1.1)	22.1	13.5–14.5	(13.9 ± 0.4)
TL	18.2	12.1–13.3	(12.6 ± 0.5)	10.4	7.6–8.5	(8.0 ± 0.4)
FL	15.8	10.0–11.6	(10.6 ± 0.6)	9.1	5.8–6.0	(5.9 ± 0.1)
HL	11.8	7.7–9.3	(8.4 ± 0.7)	8.8	5.6–5.9	(5.8 ± 0.1)
HW	10.0	7.0–8.2	(7.4 ± 0.5)	8.1	5.1–5.8	(5.3 ± 0.3)
ED	3.2	2.0–2.4	(2.3 ± 0.2)	2.5	1.7–2.4	(2.0 ± 0.3)
TY	1.5	1.0–1.3	(1.1 ± 0.1)	—	—	
IOD	4.2	2.8–3.1	(2.9 ± 0.1)	2.5	1.8–2.0	(1.9 ± 0.1)
EW	2.2	1.5–2.1	(1.8 ± 0.2)	2.2	1.0–1.6	(1.3 ± 0.2)
IND	3.0	2.3–2.4	(2.4 ± 0.0)	2.0	1.3–1.5	(1.4 ± 0.1)
E–N	4.2	3.0–3.2	(3.1 ± 0.1)	2.7	1.8–1.9	(1.9 ± 0.0)
TL/SVL	0.58	0.54–0.60		0.47	0.55–0.62	
FL/SVL	0.50	0.45–0.51		0.41	0.40–0.44	
HL/SVL	0.38	0.37–0.42		0.40	0.41–0.43	
HW/SVL	0.32	0.33–0.35		0.37	0.37–0.40	
HW/HL	0.85	0.80–0.93		0.92	0.86–0.98	
E–N/ED	1.31	1.25–1.50		1.08	0.79–1.12	
EW/IOD	0.52	0.52–0.68		0.88	0.50–0.84	
TY/ED	0.47	0.42–0.55		—	—	

tympanic membrane and annulus absent; (3) snout moderate with a small conical tubercle at its tip; snout rounded in dorsal and lateral views; (4) upper eyelid with two conical tubercles; upper eyelid slightly narrower than IOD; cranial crests absent; (5) dentigerous processes of vomers small, in an oblique row, narrowly separated; (6) males without vocal sac, vocal slits, and nuptial pads; (7) finger I shorter than finger II; discs on outer fingers broad, rounded; (8) fingers with lateral fringes; (9) ulnar and tarsal tubercles present; (10) heel with a small, conical tubercle; inner tarsal fold short, tuberclelike; (11) inner metatarsal tubercle ovoid, six times the size of ovoid outer metatarsal tubercle; prominent supernumerary plantar tubercles present; (12) toes with lateral fringes; basal toe webbing present; toe V much longer than

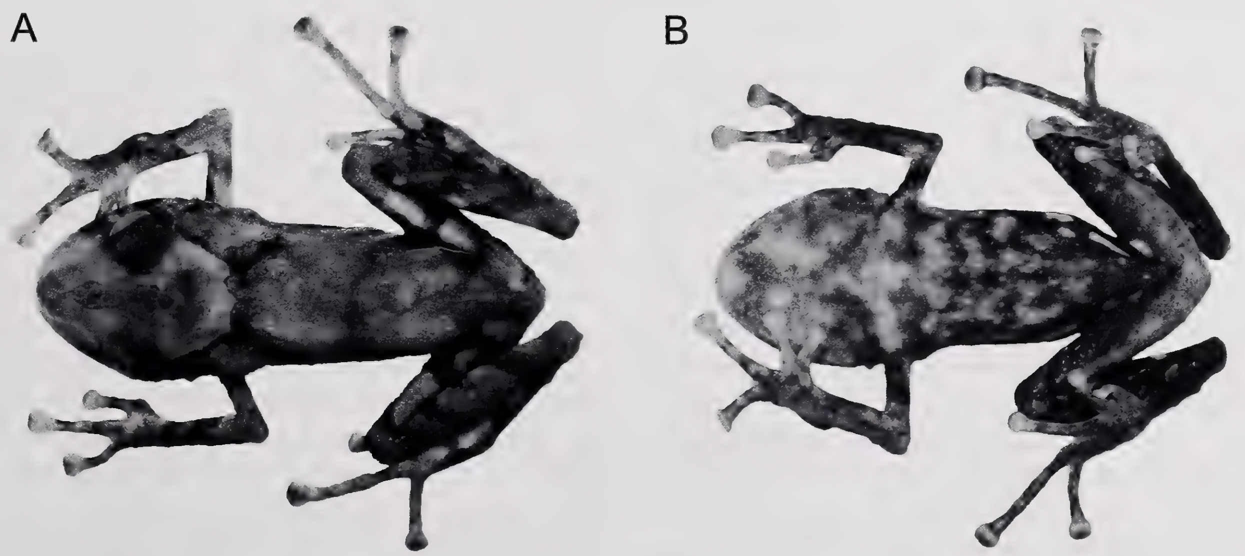


Figure 8. Dorsal (A) and ventral (B) views of *Pristimantis vilcabambae* (AMNH 153057, holotype, SVL 22.1 mm).

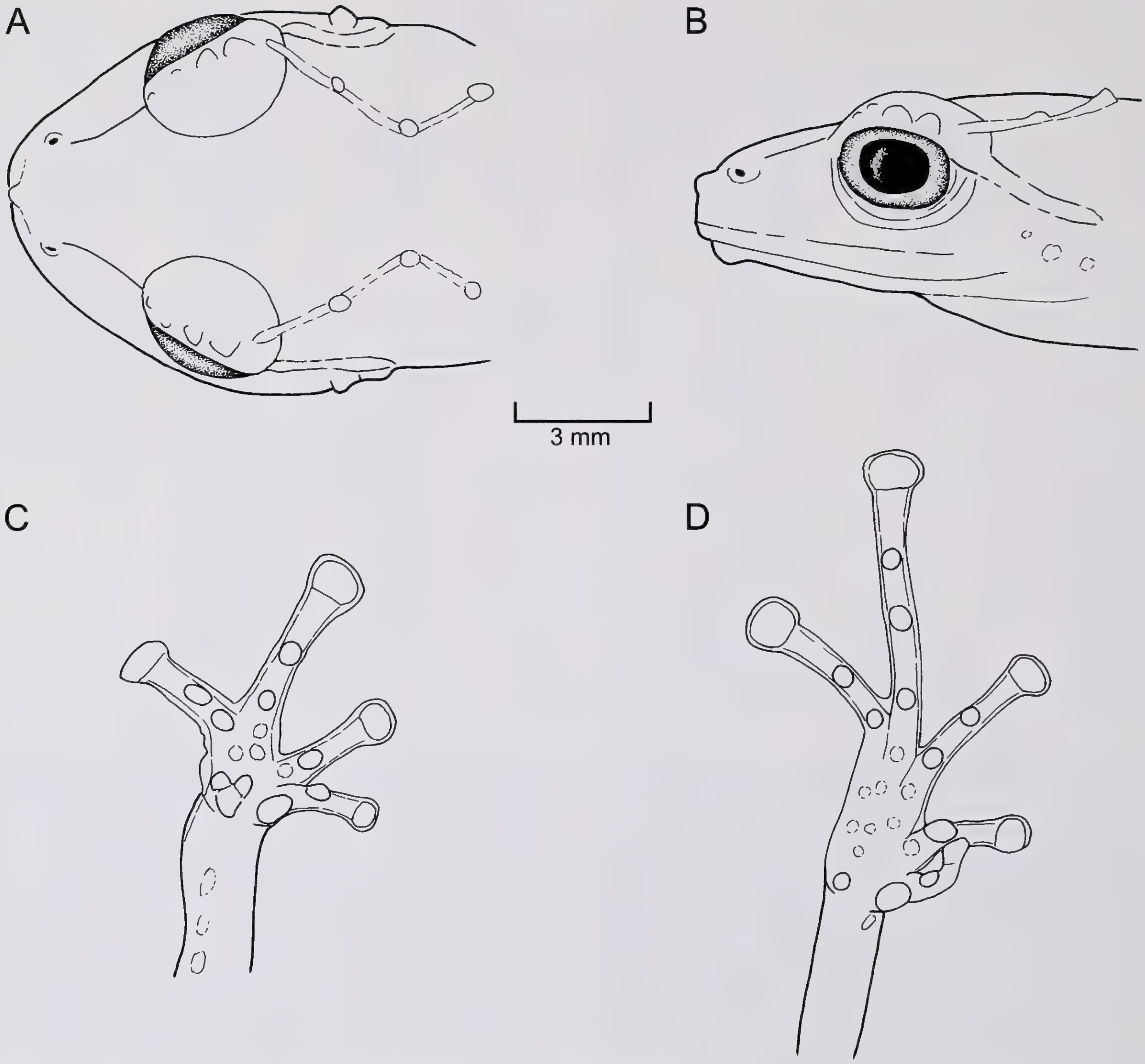


Figure 9. Dorsal (A) and lateral (B) views of head and ventral views of forefoot (C) and hind foot (D) of *Pristimantis vilcabambae* (AMNH 153057).

toe III; toe discs broad, rounded, about the same size as discs on fingers; (13) in ethanol, dorsum tan with blackish-brown H-shaped scapular fold; venter tan with dark brown flecks; groin and anterior surfaces of thighs dark brown with cream blotches; (14) SVL in single female 22.1 mm, in males 13.5–14.6 mm (n = 3).

Pristimantis vilcabambae lacks a tympanum; it has two conical tubercles on the upper eyelid, an H-shaped scapular fold, one conical tubercle on the heel, lateral fringes on the fingers and toes, many distinct supernumerary tubercles, and (in ethanol) groin and anterior surfaces of thighs dark brown with cream blotches. Eleven other species of *Pristimantis* in the Andes and Amazonian lowlands in Peru (*acuminatus, colodactylus, coronatus, croceoinguinis, cruciocularis, flavobracatus, imitatrix, lirellus, martiae, tantanti,* and *ventrimarmoratus*) lack a differentiated tympanic membrane. *Pristimantis vilcabambae* is the only one of these in the Andes of southern Peru. *Pristimantis vilcabambae* and *P. carvalhoi* are similar in size (SVL 13.5–14.6 mm in male *P. vilcabambae*; 13.5–14.8 mm in male *P. carvalhoi*; Lynch 1980), have conical tubercles on the dorsum, and an areolate venter, but *P. vil-*

cabambae (*P. carvalhoi*) lacks a tympanum (tympanic annulus visible beneath skin), has conical tubercles on the upper eyelid (no tubercles), lateral fringes on the digits (no fringes), large supernumerary tubercles on plantar surface (small supernumerary tubercles at bases of toes), and a conical tubercle on the heel (absent). *Pristimantis vilcabambae* is most similar to *P. croceoinguinis*. Both are similar in size (SVL in males 13.5–14.6 mm vs. 13.9–18.2 mm, respectively), lack dorsolateral folds, areolate venter, tubercles on the upper eyelid, and conical tubercle on the heel and have no vocal slits or nuptial pads in males. *Pristimantis vilcabambae* differs from *P. croceoinguinis* in having fingers and toes with lateral fringes (absent in *P. croceoinguinis*), dorsum shagreen with a few conical tubercles (tuberculate), supernumerary tubercles present (absent), and venter tan with dark brown blotches (tan with brown mottling). Furthermore, *P. vilcabambae* is an Andean species, whereas *P. croceoinguinis* is restricted to the upper Amazon Basin in southern Colombia, Ecuador, and extreme northeastern Peru. *Pristimantis vilcabambae* and *P. flavobracatus* from central Peru have conical tubercles on the upper eyelid and on the heel, and no vocal sac, vocal slits, or nuptial pads in males, but male *P. vilcabambae* are smaller (SVL of 13.5–14.6 mm vs. 18.2–19.6 mm), fingers and toes have lateral fringes (absent in *P. flavobracatus*), plantar surface with many, prominent supernumerary tubercles (few, low), and venter tan with dark brown blotches (dark brown).

Description of the Holotype. Head slightly broader than body, longer than wide; head width 36.7% of SVL; head length 39.8% of SVL; cranial crests absent; snout moderate, rounded in dorsal and lateral views, with a small, conical tubercle on its terminal end (Figs. 9A, B); eye diameter 92.6% of eye–nostril distance; nostrils protuberant, directed laterally; canthus rostralis slightly rounded in dorsal view, rounded in profile; loreal region slightly concave; lips rounded; upper eyelid with two conical tubercles along its outer margin; upper eyelid width 88.0% of IOD; supratympanic fold narrow, weak, more like a row of tubercles, extending from posterior edge of upper eyelid diagonally to insertion of forelimb; tympanic annulus and membrane absent; two small, conical postrictal tubercles present on both sides of head. Choanae small, ovoid, not concealed by palatal shelf of maxilla; dentigerous processes of vomers small, in an oblique row, narrowly separated, 3 teeth on left, 5 on right process of vomer; tongue slightly longer than wide (5.4 mm long; 4.9 mm wide), notched posteriorly, posterior half free.

Skin on dorsum shagreen with few conical tubercles located dorsolaterally; H-shaped occipital fold bearing three conical tubercles on each side and contacting upper eyelid (Fig. 9A); skin on flanks tuberculate forming a short dorsolateral ridge on each side of body; skin on venter areolate; weak discoidal fold present; cloacal sheath short; one enlarged, round tubercle on each side of upper half of cloacal opening. Outer surface of ulnar on left forelimb with a row of three small tubercles, on right forelimb with a low fold; palmar tubercles low, outer palmar tubercle bifid, approximately 2.5 the size of ovoid, inner palmar tubercle; subarticular tubercles well defined, ovoid in ventral view, subconical in lateral view; supernumerary palmar tubercles distinct, ovoid, approximately half size of subarticular tubercles; fingers with lateral fringes; outer fringe of finger IV continuing as discontinuous fold to outer edge of palm; finger I shorter than finger II; discs on fingers broadly expanded, approximately 2× the size of digit proximal to it, most prominent on fingers III and IV; discs slightly truncate; ventral pads of fingers well defined by circumferential grooves (Fig. 9C).

Hind limbs long, slender, tibia length 47.1% of SVL; foot length 41.1% of SVL; upper surfaces of hind limbs shagreen with small tubercles; anterior surfaces of

thighs smooth, posterior surfaces shagreen; heel with an enlarged, conical tubercle; outer surface of tarsus with two, small, low tubercles; inner tarsal fold short, tuberclelike; inner metatarsal tubercle ovoid, six times the size of round outer metatarsal tubercle; subarticular tubercles well defined, ovoid in ventral view, subconical in lateral view; plantar supernumerary tubercles distinct, about half the size of supernumerary tubercles; toes with lateral fringes; outer fringe of toe V continuing as discontinuous fold to proximal edge of plantar; basal webbing present, most prominent between toes IV and V; discs about the same size as those on fingers; discs slightly truncate; toes having ventral pads well defined by circumferential grooves; relative lengths of toes: 1 < 2 < 3 < 5 < 4 (Fig. 9D); toe V slightly longer than toe III (disc on toe III and on toe V not reaching distal subarticular tubercle on toe IV).

Measurements (in mm) of holotype: SVL 22.1; tibia length 10.4; foot length 9.1; head length 8.8; head width 8.1; eye diameter 2.5; IOD 2.5; upper eyelid width 2.2; internarial distance 2.0; eye–nostril distance 2.7.

Coloration of Holotype in Preservative. Dorsum grayish tan with a blackish-brown H-shaped scapular fold, dark brown, middorsal stripe on head extending from snout to interorbital region; forelimbs grayish tan with two narrow brown bars on lower forelimb; forefeet and hind feet tan with brown flecks; limbs grayish tan with five narrow, diagonal brown bars; canthal stripe absent, brown supratympanic stripe present; upper lip tan with brown bars below eye, two on right, three on left side; sides of head grayish tan; flanks colored like dorsum with two dark brown, broad diagonal stripes separated by a cream blotch that contains a dark brown fleck in its center; groin dark brown with a cream, ovoid blotch in left groin, and a cream, diagonal bar in right groin; anterior surfaces of thighs dark brown with two cream ovoid blotches on left thigh, and one cream longitudinal blotch on right thigh; posterior surfaces of thighs dark brown with two cream blotches on its upper half; concealed surfaces of shanks dark brown with cream blotches; throat, chest, and belly cream with dark brown blotches and small dark brown spots; posterior half of belly and anterior half of thighs dark brown; remaining ventral surfaces tan and dark brown mottled; iris dark gray.

Coloration of Holotype in Life. Unknown.

Variation. All specimens have a blackish-brown H-shaped scapular fold with conical tubercles on its outside and a conical heel tubercle as described for the holotype. Presumably as a result of preservation, the tubercles are not as distinct in the paratypes as in the holotype. Males lack vocal sac, vocal slits, and nuptial pads. Amount of cream blotches in groin, anterior surfaces of thighs and concealed surfaces of shanks is variable. All males have a dark brown interorbital bar. The smallest specimen (AMNH 153059, SVL 9.5 mm) has a dark brown dorsum with a distinct H-shaped scapular fold, dark brown venter, and tan flanks. See Table 3 for measurements and proportions.

Etymology. The specific name *vilcabambae* refers to the Cordillera Vilcabamba, a small range of the Andes Mountains in south-central Peru that extends about 260 km northwestward from the city of Cusco; the range is bordered by deep canyons formed by the Río Tambo, Río Ene, Río Apurímac, and Río Urubamba.

Distribution and Ecology. Pristimantis vilcabambae is known only from the type locality (Map 1). Nothing is known about its ecology. For comments on vegetation and herpetofaunal diversity, see paragraph on distribution and ecology of *P. tanyrhynchus.*

Phrynopus ayacucho sp. nov.
Map 1, Figures 10–11

Holotype. MCZ 24362 (Fig. 10), an adult female collected at Rapi, Provincia

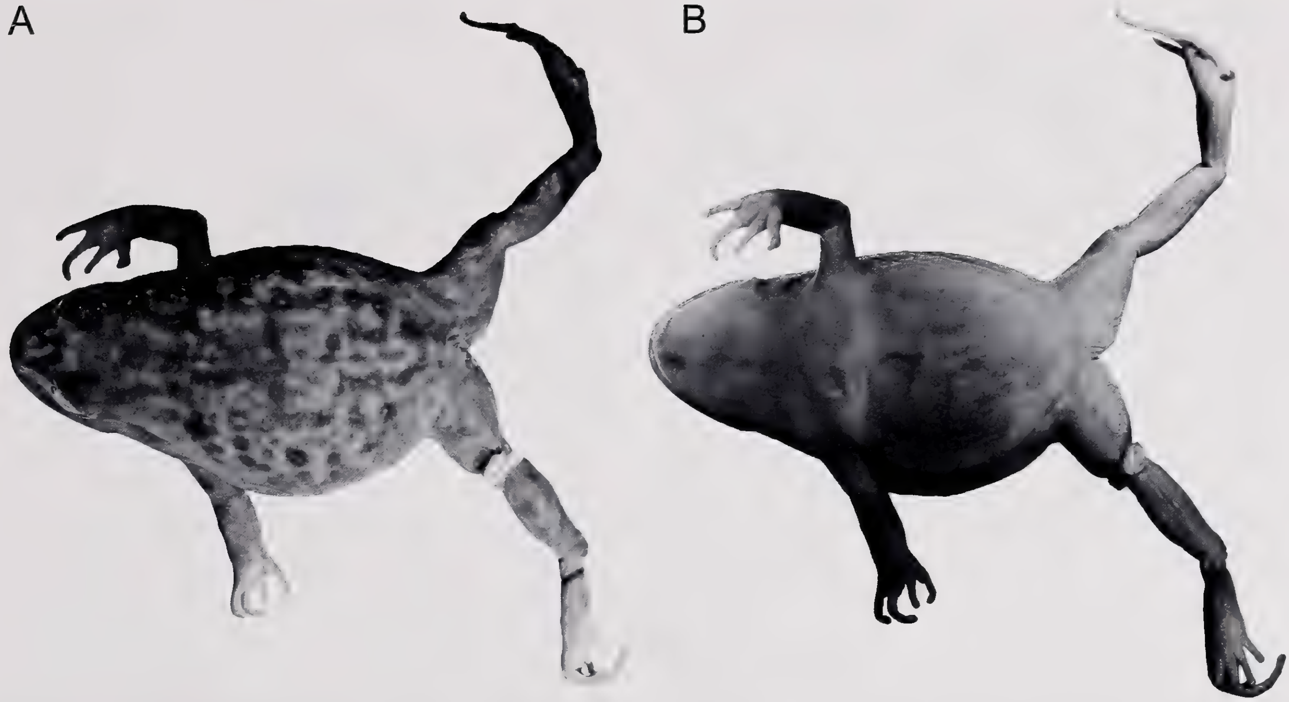


Figure 10. Dorsal (A) and ventral (B) views of *Phrynopus ayachucho* (MCZ 24362, holotype, SVL 29.2 mm).

de La Mar, Departamento de Ayacucho, Peru, by W. F. Walker, Sr.

Paratype. MCZ 24363, a juvenile collected with the holotype by W. F. Walker, Sr.

Diagnosis. A medium-sized species of *Phrynopus* having knob-shaped terminal phalanges and the following combination of characters: (1) Skin on dorsum smooth with small, elongate tubercles, forming discontinuous occipital and dorsolateral folds, skin on venter areolate; weak discoidal fold present; (2) tympanic membrane absent, tympanic annulus visible beneath skin, about one-third diameter of eye, its upper and posterolateral part covered by supratympanic fold; (3) snout short, rounded in dorsal and lateral views; (4) upper eyelid with small tubercles; width of upper eyelid narrower than IOD; cranial crests absent; (5) dentigerous processes of vomers small, oblique, broadly separated, embedded in buccal mucosa of mouth, teeth barely visible; (6) male characters unknown; (7) finger I shorter than finger II; tips of digits rounded; (8) fingers without lateral fringes; (9) ulnar and tarsal tubercles absent; (10) heel without tubercles; inner tarsal fold absent; (11) inner metatarsal tubercle moderate, elongate, 2× as large as outer; outer metatarsal tubercle rounded; few low, supernumerary plantar tubercles present; (12) toes without lateral fringes; toe webbing absent; toe V slightly longer than toe III; tips of digits slightly smaller than those on fingers; (13) in ethanol, dorsum tan with dark brown blotches; elongate tubercles ocellate colored (each tubercle tan surrounded with dark brown) forming occipital and dorsolateral folds; remaining surfaces uniformly tan; (14) SVL in single adult female 29.2 mm.

Phrynopus ayacucho is readily distinguished from other central Peruvian *Phrynopus* (except *P. peruanus*) and from southern Peruvian *P. cophites* by having a tympanum. Both *P. ayacucho* and *P. peruanus* are of similar size, but *P. ayacucho* has long, slender extremities (short, robust in *P. peruanus*), and uniformly tan venter (tan with dark gray blotches in *P. peruanus*). Southern Peruvian *Phrynopus* are much smaller (SVL 16.3 mm in *P. bagrecito,* 18.4 mm in *P. boettgeri,* 25.1 mm in *P. peruvianus*) than *P. ayacucho,* and two

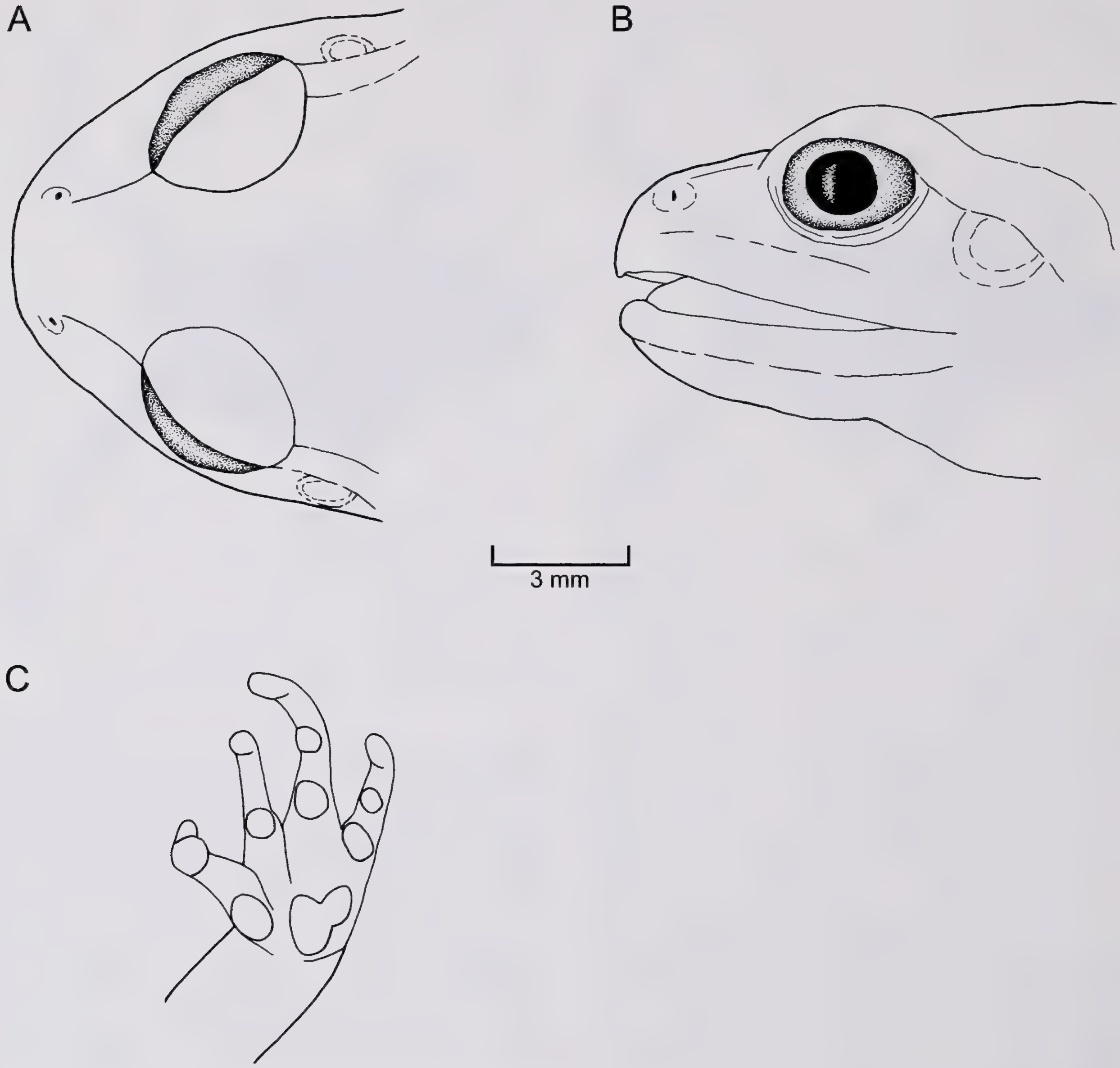


Figure 11. Dorsal (A) and lateral (B) views of head and ventral view of forefoot (C) of *Phrynopus ayachucho* (MCZ 24362). Finger 1 is swollen below tip and might indicate the presence of an internal parasite.

of them (*P. bagrecito* and *P. peruvianus*) have a tarsal fold, which is absent in *P. ayacucho*.

Superficially, *Phrynopus ayacucho* can be confused with the narrow-toed *Pristimantis lucida* (formerly *Phrynopus*), which is known from several localities in eastern Andean Ayacucho. In ethanol, both species have a tan dorsum with brown blotches and a uniformly tan venter, but *P. ayacucho* lacks a dark brown canthal stripe and interorbital bar (both present in *P. lucida*). Furthermore, *P. ayacucho* has a short snout (long in *P. lucida*), has the first finger much shorter than second (slightly shorter), fingers and toes without lateral fringes (fringes present), toe V longer than toe III (equal length), and small dentigerous processes of vomers (prominent). *Pristimantis pereger* (formerly *Phrynopus*) is known from elevations of 1,650–2,900 m on the eastern slopes of the Cordillera Oriental and Cordillera Vilcabamba in Departamento de Ayacucho. It has weak circumferential grooves (absent in *P. ayacucho*) on the digital discs on fingers and toes, and the digital groove is interrupted by a small papillalike projection on the tip of the digit

in between the pad and the disc cover (Lehr and Aguilar, 2006).

Description of the Holotype. Head narrower than body and about as wide as long; head width 33.6% of SVL; head length 33.2% of SVL; snout short, rounded in dorsal and lateral views (Figs. 11A, B); eye diameter larger than eye–nostril distance (eye–nostril distance 89.7% of length of eye); nostrils not protuberant, directed dorsolaterally; canthus rostralis straight in dorsal view, rounded in section; loreal region slightly concave; lips rounded; upper eyelid bearing small, low tubercles; width of upper eyelid narrower than IOD (upper eyelid width 74.2% of IOD); supratympanic fold short, narrow; tympanic membrane absent, tympanic annulus present beneath skin; tympanum length 35.5% of eye length, separated from eye by distance equal to length of tympanum; tympanum round, its upper and posterolateral margin concealed by supratympanic fold; one elongate, two low postrictal tubercles present on left side (one on right side) of head. Choanae small, ovoid, not concealed by palatal shelf of maxilla; dentigerous processes of vomers small, oblique, broadly separated, situated posteromedial to choanae, left dentigerous process bearing 2 minute teeth, right dentigerous process without teeth; tongue 1.5× as long as wide (length 6.3 mm, width at midlength of tongue 4.2 mm), not notched posteriorly, posterior one-fourth free.

Skin on dorsal surfaces smooth with low, elongate tubercles forming a discontinuous occipital and dorsolateral fold, flanks tuberculate; venter areolate; weak discoidal fold present; cloacal sheath short, one large, flat tubercle on both sides of cloaca next to its lower margin. Outer ulnar tubercles absent; palmar tubercles low, outer palmar tubercle bifid, approximately 2× the size of elongate, inner palmar tubercle; supernumerary tubercles close to base of fingers, round, low, half the size of subarticular tubercles; subarticular tubercles prominent, ovoid in dorsal view, rounded in lateral view; fingers without lateral fringes; finger I shorter than finger II; tips of fingers rounded (Fig. 11C). Hind limbs slender, tibia length 32.2% of SVL; foot length 36.3% of SVL; upper surfaces of hind limbs smooth with scattered low tubercles; proximal posteroventral surfaces of thighs coarsely areolate; heel without tubercles; outer surface of tarsus without tubercles; tarsal fold absent; inner metatarsal tubercle elevated, elongate, about 2× ovoid outer metatarsal tubercle; few, low plantar supernumerary tubercles; subarticular tubercles well defined, ovoid in dorsal view and rounded in lateral view; toes without lateral fringes; toe webbing absent; tips of toes rounded; relative lengths of toes: $1 < 2 < 3 < 5 < 4$; toe V slightly longer than toe III (tip of toe III reaching middle of penultimate subarticular tubercle on toe IV, tip of toe V not reaching ultimate subarticular tubercle on toe IV).

Measurements (in mm) of holotype: SVL 29.2; tibia length 9.4; foot length 10.6; head length 9.7; head width 9.8; eye diameter 2.9; tympanum diameter 1.0; IOD 3.1; upper eyelid width 2.3; internarial distance 2.4; eye–nostril distance 2.6.

Coloration of Holotype in Preservative. Dorsum tan with dark brown blotches; elongate tubercles ocellate in color (each tubercle tan surrounded with dark brown) forming occipital and dorsolateral folds; head dorsally with brown blotches except for narrow tan interorbital bar; dark brown supratympanic stripe present; extremities dorsally with dark brown blotches; remaining surfaces uniformly tan.

Coloration of Holotype in Life. Unknown.

Variation. The only other known specimen is a juvenile of 14.8 mm SVL. Toe V is shorter than toe III on both hind feet. No variation in coloration pattern could be observed.

Etymology. The specific name, a noun in apposition, refers to the Departamento de Ayacucho in southern Peru where the species was collected.

Figure 12. Dorsal (A) and ventral (B) views of *Phrynopus kotosh* (FSM 103969, holotype, SVL 23.2 mm).

Distribution and Ecology. The species is only known from the type locality in northeastern Departamento de Ayacucho near Chiquintirca (Map 1). Rapi is likely the short form for Hacienda Rapi (13°5′51″S, 73°48′49″W). *Telmatobius walkeri* was also described from "Rapi, one hundred and eight kilometers east of Ayacucho, Department of Ayacucho, Peru" (Shreve, 1941:79). Hacienda Rapi is at 3,411 m above sea level. No other species of *Phrynopus* or *Pristimantis* are known from this locality. Nothing is known about its ecology.

Phrynopus kotosh sp. nov.

Map 1, Figures 12–13

Holotype. FSM 103969 (Fig. 12), an adult female collected at 10.8 km W of Huancapallac at 2,950 m on 9 March 1969, Provincia de Huánuco, Departamento de Huánuco, Peru, by F. G. Thompson.

Paratypes. Two adult females (FSM 103967–68), four adult males (FSM 103970–73), collected on 9 March 1969 with the holotype by F. G. Thompson.

Diagnosis. A medium-sized species of *Phrynopus* having knob-shaped terminal phalanges and the following combination of characters: (1) Skin on dorsum shagreen with scattered tubercles, that on venter areolate; discoidal fold absent, thoracical fold present; discontinuous dorsolateral folds present; (2) tympanic membrane and tympanic annulus absent; (3) snout acutely rounded in dorsal view, rounded in lateral view; (4) upper eyelid with small tubercles; width of upper eyelid narrower than IOD; cranial crests absent; (5) dentigerous processes of vomers ovoid, oblique, widely separated, each bearing 2 long teeth; (6) males lacking vocal slits and nuptial pads; (7) finger I shorter than finger II; tips of digits rounded; (8) fingers without lateral fringes; (9) ulnar and tarsal tubercles present; (10) heel with small tubercles; inner tarsal fold absent; (11) inner metatarsal tubercle ovoid, 2× as large as outer; outer metatarsal tubercle conical, rounded; many low, supernumerary plantar tubercles present; (12) toes without lateral fringes; basal toe webbing present; toe V slightly longer or slightly shorter than toe III; toe tips rounded, as large as those on fingers; (13) in ethanol, dorsum and venter tan and brown mottled, venter paler than dorsum; (14) SVL in adult females 23.2–26.2 mm (n = 3), in adult males 14.6–17.4 mm (n = 4).

Phrynopus kotosh is readily distinguished from its congeners by having the combination of dentigerous processes of

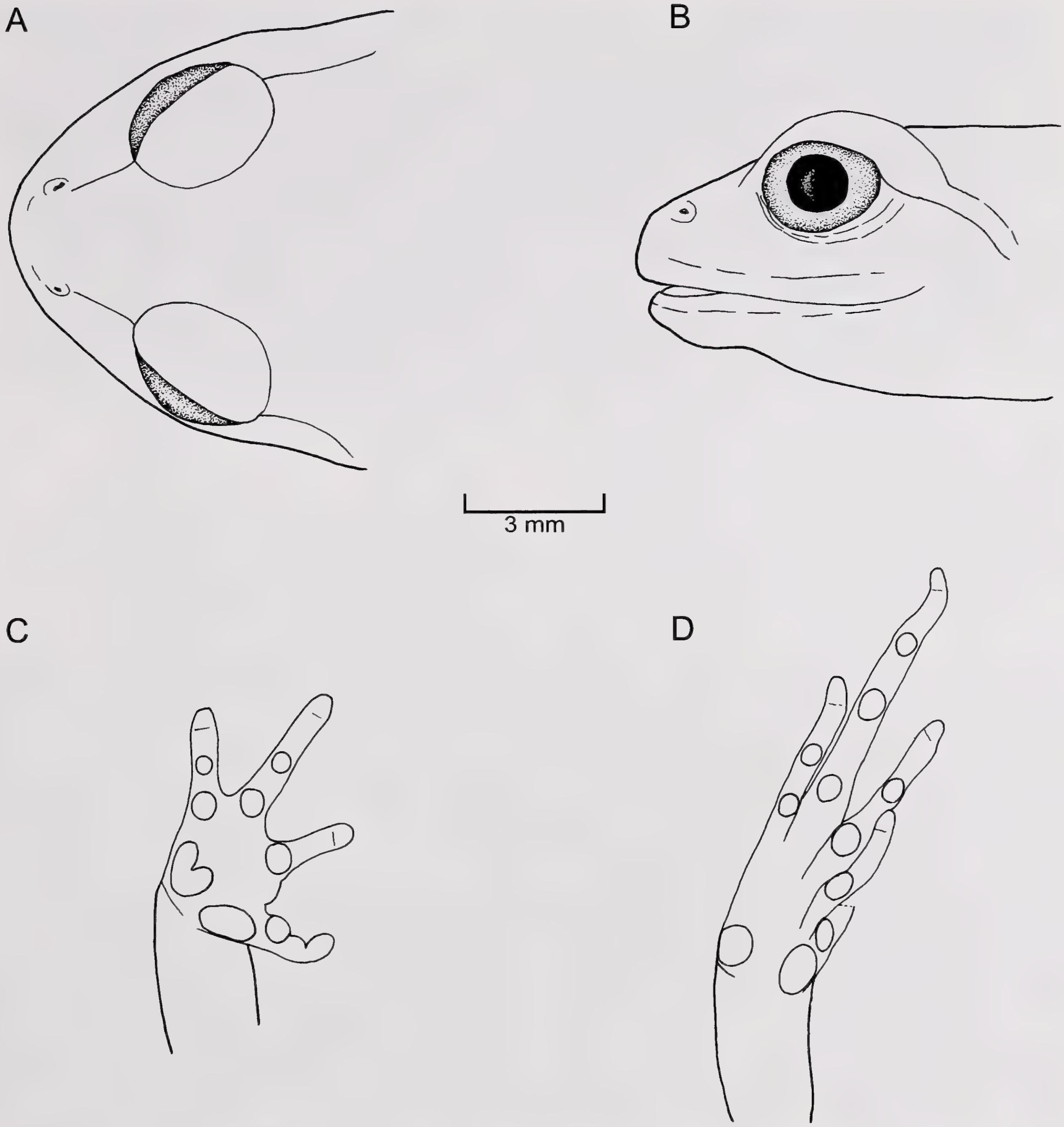


Figure 13. Dorsal (A) and lateral (B) views of head and ventral views of forefoot (C) and hind foot (D) of *Phrynopus kotosh* (FSM 103969). Tip of toe I is missing.

vomers (each bearing 2 relatively long teeth), dorsolateral folds, and no tympanum. Sixteen species of Peruvian *Phrynopus* lack a tympanum. Of these, only three species (*P. bracki, dagmarae,* and *kauneorum*) have dentigerous processes of vomers, and only *P. dagmarae* has weak dorsolateral folds (erroneously mentioned as absent according to original description by Lehr et al. [2002]). *Phrynopus kotosh* and *P. dagmarae* are similar, but they can be distinguished as follows (characters for *P. dagmarae* in parenthesis): dorsolateral folds discontinuous (weak and short), fingers and toes without lateral fringes (narrow fringes present; erroneously mentioned as absent in the original description by Lehr et al. [2002]), heel with small tubercles (with one conical tubercle), plantar supernumerary tubercles present (absent).

TABLE 4. MEASUREMENTS (MM) AND PROPORTIONS OF ADULT *PHRYNOPUS KOTOSH* AND *P. OBLIVIUS*; RANGE (MEAN ± 1 SD).

	P. kotosh		*P. oblivius*	
Character	Females (n = 3)	Males (n = 4)	Females (n = 3)	Males (n = 4)
SVL	23.2–26.2 (24.4 ± 1.3)	14.6–17.4 (15.5 ± 1.1)	21.8–23.9 (22.7 ± 0.9)	17.5–19.7 (18.6 ± 0.8)
TL	8.6–9.3 (9.0 ± 0.3)	6.0–6.7 (6.4 ± 0.2)	8.7–9.1 (8.9 ± 0.2)	6.6–8.1 (7.5 ± 0.5)
FL	9.4–10.5 (9.9 ± 0.5)	6.1–7.9 (7.0 ± 0.6)	7.9–9.4 (8.8 ± 0.7)	6.8–8.1 (7.5 ± 0.5)
HL	8.3–9.6 (8.8 ± 0.6)	5.5–6.8 (6.0 ± 0.6)	7.5–7.7 (7.6 ± 0.1)	6.3–7.1 (6.7 ± 0.3)
HW	7.8–8.6 (8.1 ± 0.4)	5.2–5.9 (5.5 ± 0.3)	7.5–7.6 (7.6 ± 0.0)	6.5–7.1 (6.8 ± 0.2)
ED	2.2–2.5 (2.3 ± 0.1)	1.5–1.9 (1.7 ± 0.2)	2.2–2.6 (2.4 ± 0.2)	2.0–2.2 (2.2 ± 0.1)
IOD	2.3–2.6 (2.5 ± 0.1)	2.0–2.3 (2.2 ± 0.1)	2.5–2.8 (2.7 ± 0.1)	2.4–2.6 (2.5 ± 0.1)
EW	2.0–2.4 (2.2 ± 0.2)	1.2–1.6 (1.4 ± 0.1)	1.5–2.0 (1.8 ± 0.2)	1.3–1.5 (1.4 ± 0.1)
IND	1.8–2.0 (1.9 ± 0.1)	1.4–1.5 (1.5 ± 0.0)	1.8–2.1 (1.9 ± 0.1)	1.5–1.8 (1.7 ± 0.1)
E–N	2.1–2.7 (2.3 ± 0.3)	1.4–1.8 (1.6 ± 0.1)	1.8–1.8 (1.8 ± 0.0)	1.5–1.9 (1.7 ± 0.2)
TL/SVL	0.34–0.39	0.39–0.42	0.38–0.40	0.38–0.43
FL/SVL	0.40–0.41	0.42–0.45	0.35–0.43	0.38–0.44
HL/SVL	0.35–0.37	0.36–0.39	0.32–0.35	0.34–0.37
HW/SVL	0.33–0.34	0.33–0.36	0.32–0.35	0.35–0.39
HW/HL	0.90–0.94	0.87–0.95	0.99–1.00	0.96–1.05
E–N/ED	0.84–1.23	0.82–1.07	0.69–0.82	0.68–0.86
EW/IOD	0.77–1.04	0.57–0.73	0.51–0.80	0.54–0.58

Both *Phrynopus kotosh* and *P. oblivius* are of similar size (see Table 4); males lack vocal sacs and nuptial pads. *Phrynopus kotosh* has weak, discontinuous dorsolateral folds (absent in *P. oblivius*), toe V and toe III about equal in length (toe V slightly longer), and dentigerous processes of vomers (absent). Superficially, *Phrynopus kotosh* is similar to *P. montium,* with which it has been confused (e.g., Duellman, 2000; Lehr et al. 2005). Both are similar in size and are brown with the dorsum being darker than the venter. Furthermore, *Phrynopus montium* has a tympanic annulus visible beneath the skin (tympanic annulus absent in *P. kotosh*), and males have a vocal sac and vocal slits (absent).

Description of the Holotype. Head narrower than body, slightly longer than wide; head width 33.6% of SVL; head length 35.8% of SVL; snout short, acutely rounded in dorsal view, rounded in lateral view (Figs. 13A, B), with terminal tubercle on its tip; eye diameter slightly larger than eye–nostril distance; nostrils slightly protuberant, directed dorsolaterally; canthus rostralis straight in dorsal view, rounded in profile; loreal region plain; lips rounded; upper eyelid with small tubercles; width of upper eyelid narrower than IOD (upper eyelid width 76.9% of IOD); supratympanic fold short, narrow; tympanic membrane and tympanic annulus absent, two enlarged, ovoid, conical postrictal tubercles on right side of head, one elongate ridge on left side of head present. Choanae small, ovoid, not concealed by palatal shelf of maxilla; dentigerous processes of vomers moderate, ovoid, oblique, situated posteromedially to choanae, each vomer bearing 2 elongate teeth, vomers narrowly separated; tongue 1.5× as long as wide not notched posteriorly, posterior one-fourth free.

Skin on dorsum shagreen with scattered tubercles, discontinuous dorsolateral folds present; skin on flanks coarsely tuberculate; skin on venter areolate, other ventral surfaces smooth; discoidal fold not evident, thoracical fold present; cloacal sheath short; large tubercles absent in cloacal region. Outer surface of ulnar each with a low ridge; palmar tubercles low, outer palmar tubercle bifid, approximately 1.5× the size of elongate, inner palmar tubercle; supernumerary tubercles close to base of fingers, round, low, half the size of subarticular tubercles; subarticular tuber-

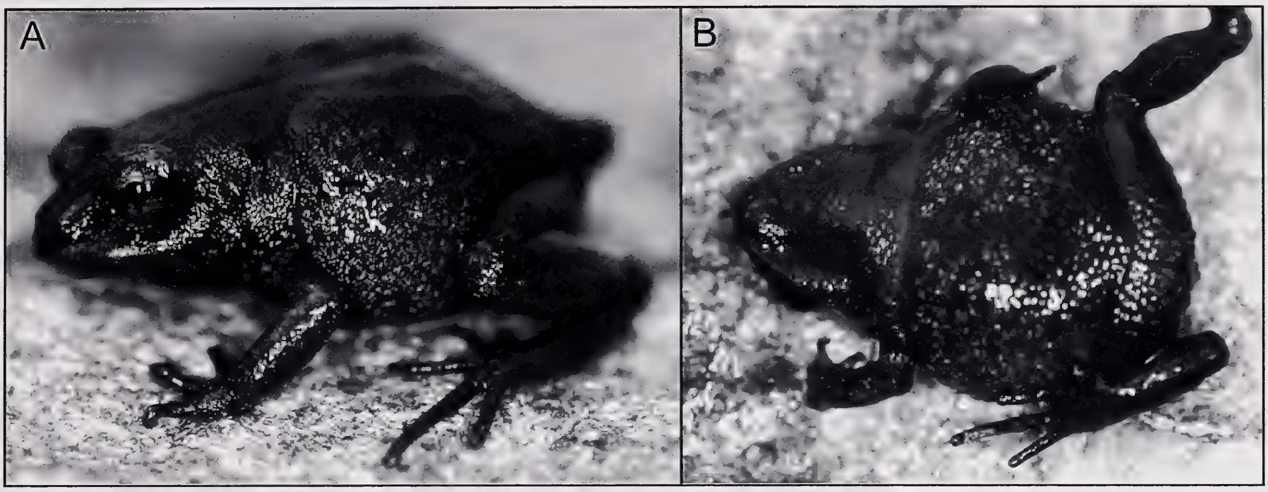


Figure 14. Dorsal (A) and ventral (B) views of *Phrynopus oblivius* (MHNSM 19979, holotype, SVL 21.8 mm).

cles prominent, ovoid in dorsal view, rounded in lateral view; fingers without lateral fringes; finger I shorter than finger II; tips of digits rounded (Fig. 13C).

Hind limbs slender, tibia length 37.1% of SVL; foot length 40.5% of SVL; upper surface of hind limbs smooth with small, scattered tubercles; posterior and ventral surfaces of thighs coarsely areolate; heel with small, round tubercles; outer surface of tarsus each with three, small, ovoid tubercles; inner metatarsal tubercle elevated, ovoid, about 2× conical, rounded outer metatarsal tubercle; many, low plantar supernumerary tubercles present; subarticular tubercles well defined, ovoid in dorsal view, rounded in lateral view; toes without lateral fringes, basal webbing present; toe tips rounded as large as those on fingers; relative lengths of toes: 1 < 2 < 3 < 5 < 4 (right foot), 1 < 2 < 4 < 5 < 3 (left foot) (Fig. 13D); toe V slightly longer or shorter than toe III.

Measurements (in mm) of holotype: SVL 23.2; tibia length 8.6; foot length 9.4; head length 8.3; head width 7.8; eye diameter 2.5; IOD 2.6; upper eyelid width 2.0; internarial distance 1.8; eye–nostril distance 2.1.

Coloration of Holotype in Preservative. Dorsum mottled tan and brown, discontinuous dorsolateral folds pale gray; each lower forelimb with one dark brown blotch, limbs with dark brown blotches; weakly defined dark brown canthal and supratympanic stripes present; dark brown blotch on upper lip below eye; venter tan and brown mottled, paler than dorsum; iris dark gray.

Coloration of Holotype in Life. Unknown.

Variation. No variation in coloration pattern is evident, except that one specimen (FSM 103973) has a tan middorsal stripe. Furthermore, this specimen has more prominent dorsolateral folds than the other specimens. See Table 1 for ranges and proportions of the type series.

Etymology. The specific name *kotosh* is a noun and refers to the pre-Columbian culture Kotosh (around 3000 B.C.). Kotosh ruins ("temple of the crossed arms") are among the earliest signs of civilization in Peru. They are located in the Río Mito/Río Higueras Valley west of Huánuco, where the new species was found.

Distribution and Ecology. The new species is only known from the type locality in the eastern part of the Cordillera Central (Map 1). Nothing is known about its natural history.

Phrynopus oblivius sp. nov.
Map 1, Figures 14–15

Holotype. MHNSM 19979 (Fig. 14), an adult female collected below the village of Maraynioc (11°2039.4″S, 75°26′44.7″W), Vitoc Valley, at 3,220 m on 13 December

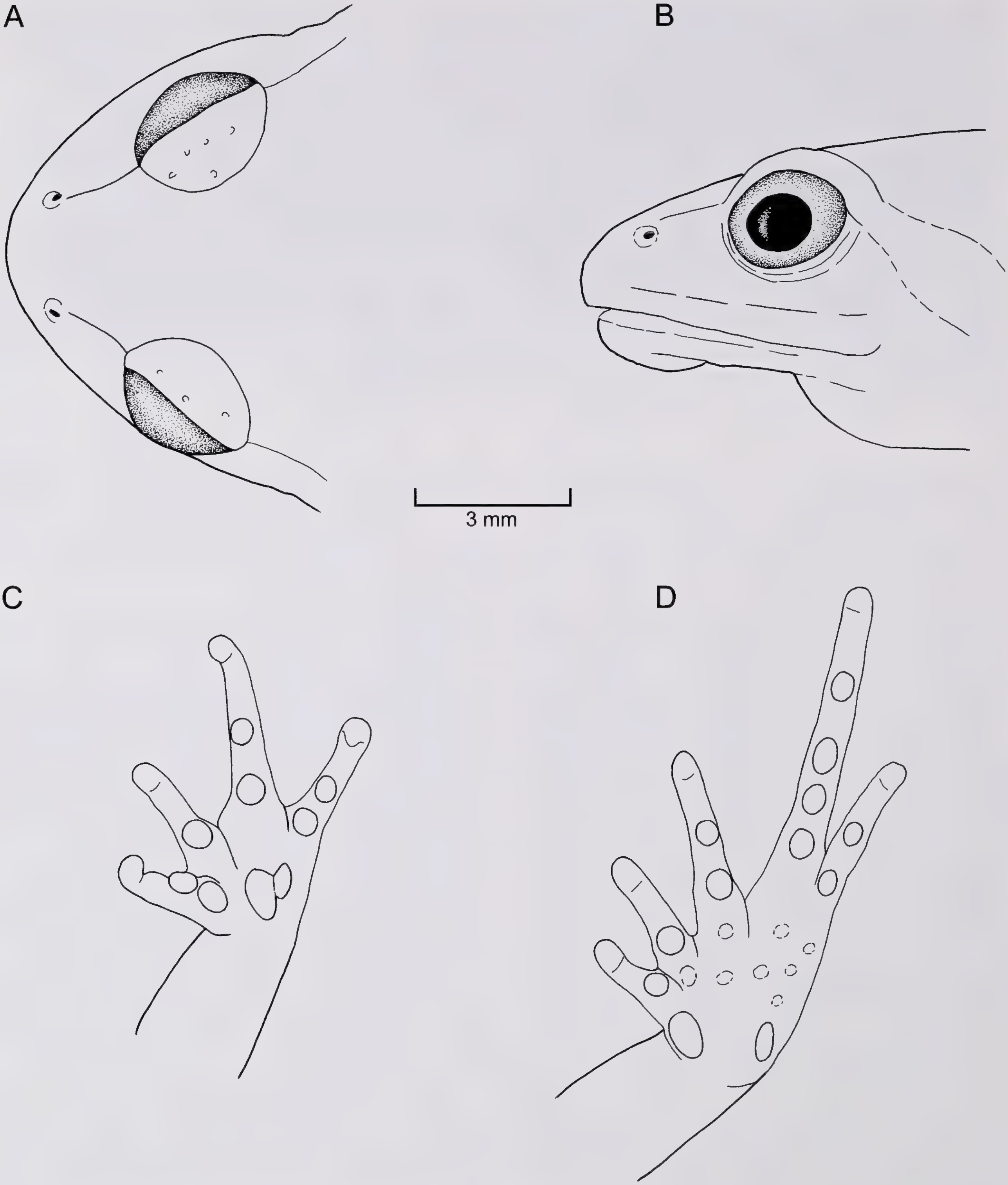


Figure 15. Dorsal (A) and lateral (B) views of head and ventral views of forefoot (C) and hind foot (D) of *Phrynopus oblivius* (MHNSM 19979).

2005, Provincia de Tarma, Departamento de Junín, Peru, by E. Lehr.

Paratypes. Six (four males: MHNSM 19981, MTD 46803–05; two females: MHNSM 19980, MTD 46806) collected at Maraynioc (11°20′33.2″S, 75°26′39.2″W), Vitoc Valley, at 3,210 m on 14 December 2005 (MTD 46804 on 13 December 2005), Provincia de Tarma, Departamento de Junín, Peru, by E. Lehr and J. Boettger;

three females (MCZ 24354, 24357, USNM 217417) obtained at Maraynioc, 45 mi NE of Tarma, Peru, by J. A. Griswold, Jr.

Referred Specimens. A series of 251, mostly untagged specimens (MCZ 24351–53, 24355–56, 24358) in medium to bad condition, USNM 217416, all collected at Maraynioc, 45 mi NE of Tarma, Peru, by J. A. Griswold, Jr.

Diagnosis. A small species of *Phrynopus* having knob-shaped terminal phalanges and the following combination of characters: (1) Skin on dorsum smooth with few, small tubercles, that on venter weakly areolate; discoidal fold present; dorsolateral folds absent; (2) tympanic membrane and tympanic annulus absent; (3) snout rounded in dorsal and lateral views; (4) upper eyelid with small tubercles; width of upper eyelid narrower than IOD; cranial crests absent; (5) dentigerous processes of vomers absent; (6) males lacking vocal slits and nuptial pads; (7) finger I shorter than finger II; tips of digits rounded; (8) fingers without lateral fringes; (9) ulnar and tarsal tubercles present; (10) heel with small tubercles; inner tarsal fold absent; (11) inner metatarsal tubercle small, ovoid, 2× as large as outer; outer metatarsal tubercle small, rounded; low, supernumerary plantar tubercles present; (12) toes without lateral fringes; toe webbing absent; toe V slightly longer than toe III; toe discs slightly smaller than those on fingers; (13) in life, dorsum dark brown with small, white spots, venter reddish brown with small, white spots; iris gold with black reticulations; (14) SVL in adult females 21.8–23.9.0 mm (n = 3), in adult males 17.5–19.7 mm (n = 4).

Phrynopus oblivius is readily distinguished from all species in the genus by its small size; smooth skin with few, small tubercles; and dark brown dorsum and reddish brown venter. It shares the absence of a tympanum with 14 other species in central Peru. Both *Phrynopus oblivius* and *P. kotosh* are of similar size (see Table 4); males lack vocal sacs and nuptial pads. *Phrynopus oblivius* (*P. kotosh*) has dorsolateral folds absent (weak, discontinuous), toe V slightly longer than toe III (about equal in length), and dentigerous processes of vomers absent (present).

Phrynopus oblivius has been confused with *P. montium* in the herpetological collection of the MCZ and in several publications (e.g., Duellman, 2000; Lehr et al., 2005). *Phrynopus oblivius* (*P. montium*) lacks a tympanic membrane and annulus (annulus visible beneath skin), and males lack vocal slits and a vocal sac (both present; Lynch, 1975), but male *P. oblivius* lack nuptial pads (present dorsally on swollen thumb; MCZ 22859). *Phrynopus montium* is only known from the type locality at Cascas approximately 30 km (straight-line) from Maraynioc in Departamento de Junín.

Description of the Holotype. Head narrower than body, about as wide as long; head width 34.9% of SVL; head length 35.3% of SVL; snout short, rounded in dorsal and lateral views (Figs. 15A, B); eye diameter larger than eye–nostril distance (eye–nostril distance 81.8% of length of eye); nostrils slightly protuberant, directed dorsolaterally; canthus rostralis straight in dorsal view, rounded in section; loreal region slightly concave; lips rounded; upper eyelid bearing few small tubercles; upper eyelid width 53.6% of IOD; supratympanic fold narrow and low; tympanic annulus and tympanic membrane absent; two enlarged postrictal tubercles on each side of head. Choanae small, ovoid, not concealed by palatal shelf of maxillary arch; dentigerous processes of vomers absent; tongue 2× as long as wide, slightly notched posteriorly, posterior one-half free.

Skin on dorsum with few, small tubercles more dense on posterior part of dorsum; dorsolateral folds absent; skin on flanks areolate with many tubercles; skin on venter weakly areolate, that on posterior ventral surfaces of thighs coarsely areolate; skin on other ventral surfaces smooth; discoidal fold present; cloacal sheath short, large tubercles in cloacal region absent. Three small, low ulnar tuber-

cles on each forelimb; palmar tubercles low, outer palmar tubercle bifid, approximately 2× size of ovoid, inner palmar tubercle; supernumerary tubercles present, round, low, half size of subarticular tubercles; subarticular tubercles ovoid, low, well defined on base of fingers; fingers without lateral fringes; finger I shorter than finger II; tips of digits rounded (Fig. 15C). Hind limbs slender, tibia length 39.9% of SVL; foot length 43.1% of SVL; upper surfaces of hind limbs smooth with few scattered tubercles; heel bearing small tubercles; outer surface of tarsus each with three, low tubercles; tarsal fold absent; inner metatarsal tubercle elevated, ovoid, about 1.5× ovoid outer metatarsal tubercle; many small, low plantar supernumerary tubercles present; subarticular tubercles well defined at base of fingers, ovoid in dorsal view and rounded in lateral view; toes without lateral fringes; tips of digits rounded; relative lengths of toes: $1 < 2 < 3 < 5 < 4$ (Fig. 15D); toe V slightly longer than toe III (tip of toe III extending to midlength of penultimate subarticular tubercle on toe IV, tip of toe V not reaching ultimate subarticular tubercle on toe IV).

Measurements (in mm) of holotype: SVL 21.8; tibia length 8.7; foot length 9.4; head length 7.7; head width 7.6; eye diameter 2.2; IOD 2.8; upper eyelid width 1.5; internarial distance 1.9; eye–nostril distance 1.8.

Coloration of Holotype in Preservative. Dorsum grayish brown; gray interorbital stripe; flanks paler than dorsum; brown canthal and supratympanic stripes; brown bar on upper lip below eye; venter tan and dark brown mottled; inner 2 fingers and inner 3 toes dorsally pale gray, outer once brown; forefoot and hind foot ventrally tan and brown mottled.

Coloration of Holotype in Life. Dorsum, flanks, and venter chocolate brown with small white spots. Black canthal and supratympanic stripes present, black blotch on upper lip below eye; iris gold with black reticulations (based on photos of live specimen).

Variation. Coloration is variable. One specimen (MTD 46804) has tan middorsal and midventral stripes, tan stripes ventrally on forelimbs extending across chest, and ventrally on hindlimbs; the dorsum and flanks of one specimen (MTD 46803) are pale reddish brown with dark brown blotches, and the venter of one specimen (MTD 46805) is orange-brown with small white spots on the thighs. See Table 4 for measurements and proportions.

Etymology. The specific name is the past tense of the Latin verb *oblitus*, meaning forget. The specific name refers to the fact that *Phrynopus oblivius* was confused with *P. montium* for many years and not recognized as a distinct species.

Distribution and Ecology. Phrynopus oblivius is known from elevations of 3,210–3,220 m in the Vitoc Valley (Map 1). Individuals were found in remnants of a cloud forest beyond the old village and former Hacienda Maraynioc; all were found during day on humid ground beneath rocks next to a small creeks. One specimen (MTD 46804) was found under a rock together with *Gastrotheca griswoldi* (MTD 46811). No other anurans are known from the type locality.

DISCUSSION

Three of the new species of *Pristimantis* were obtained from the Cordillera de Vilcabamba in southern Peru, which is known for high biological diversity and endemism. The Cordillera de Vilcabamba is mostly separated from the major Cordillera Oriental of the Andes; the two ranges are connected only at the southern end of the Cordillera de Vilcabamba. This isolation has created unique characteristics of the Cordillera resulting in a highly endemic flora and fauna. For a historic overview of the scientific exploration of the Cordillera de Vilcabamba, which started in the late 1960s and mainly focused on birds and mammals, see Alonso et al. (2001). In 1997 and 1998, anthropological, botanical, and zoological expeditions assessed the biodiversity at several sites in the northern

and southern parts of the Cordillera de Vilcabamba. The results published by Alonso et al. (2001) contained chapters on the herpetofauna (Icochea et al., 2001a; Rodríguez, 2001) and two lists of species in the appendix (Icochea et al., 2001b; Rodríguez and Rivera, 2001). These authors mentioned that the anuran diversity is high and endemic and assumed possible new species of frogs but pointed out that comparisons with specimens needed to be made. *Pristimantis tanyrhynchus* is similar to *P. rhabdolaemus* from southern Peru and Bolivia, *P. vilcabambae* shows similarities with *P. croceoinguinis* from the Amazon basin in northern Peru and southern Ecuador. An interesting finding is that *P. seorsus* shares morphological characteristics with other members of the *P. orestes* Group, which was known only from the Cordillera Occidental in northern Peru (Lehr and Duellman, 2007). Presently, *P. seorsus* is the only species of *Pristimantis* attaining an elevation of 3,350 m in southern Peru. Two species (*P. seorsus, P. vilcabambae*) lack a tympanum. The absence of a tympanum for eleutherodactyline frogs in central Peru and its correlation with elevation has been graphically demonstrated by Lehr et al. (2006). Hopefully, tissue samples will become available in the future to assess phylogeographic relationships of the anuran fauna from the Vilcabamba region with species from other Andean regions.

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APPENDIX

Specimens Examined

Pristimantis carvalhoi: PERU: HUÁNUCO: W slope Serrania de Sira: KU 154868; PASCO: Nevati, KU 144312.

Pristimantis cordovae: PERU: LA LIBERTAD: ca. 8 km NE Quiruvilca, 3,542 m: MHNSM 21990 (holotype), MHNSM 21991, 21998, 21999 (paratypes).

Pristimantis corrugatus: PERU: SAN MARTÍN: Ullilen, 3,000 m: MHNSM 28063 (holotype); Quintecocha, 3,130 m: MHNSM 28062, 28064–67 (paratypes).

Pristimantis croceoinguinis: ECUADOR: NAPO: Santa Cecilia: KU 104576–84, 104614–16, 109078–85, 110790–93.

Pristimantis lanthanites: PERU: LORETO: junction Río Yanamono and Río Amazonas, 210 m: KU 220446, 220898, San Jacinto, 175 m: KU 222000–01.

Pristimantis lucida: PERU: Ayacucho: 7 km N Mahuayura, N slope Abra Tapuna, 3,710 m: KU 162427–34 (paratypes).

Pristimantis melanogaster: PERU: AMAZONAS: Chachapoyas, N slope Abra Barro Negro, 28 km SSW Leimebamba, 3,470 m: KU 212321 (holotype), 212322–23 (paratypes), 218513 (paratype); 25.5 km SSW Leimebamba, 3,300 m: KU 181281 (paratype).

Pristimantis muscosus: PERU: SAN MARTIN: E slope Abra Pardo Miguel, 1,800 m, KU 200479–81 (paratypes), 200482 (holotype).

Pristimantis orestes: ECUADOR: LOJA: 11 km NE Urdaneta, 2,970 m: KU 141998 (holotype), 141999–003 (paratypes); 10 km S Saraguro, 3,100 m: KU 141996–97 (paratypes).

Pristimantis ornatus: PERU: PASCO: Cillapata (ca. 1.5 km NNE Auquimarca), 2,900 m: MHNSM 20664 (holotype), MHNSM 17831, 20665–71, MTD 44766–68, 44770–72, 45073 (paratypes).

Pristimantis pataikos: AMAZONAS: Chachapoyas, N slope Abra Barro Negro, 28 km SSW Leimebamba, 3,470 m: KU 212320 (holotype).

Pristimantis pereger: PERU: AYACUCHO: Yanamonte, 2,600 m: MHNSM 19982–84, MTD 46807–09.

Pristimantis pharangobates: CUSCO: Buenos Aires, 2,400 m: KU 173236 (holotype), 173237–53 (paratypes).

Pristimantis pinguis: PERU: CAJAMARCA: 23 km SW Celendin, 3,050 m: KU 18283 (holotype), KU 18282, 18284 (paratypes), near Chugur: SMF 81763 (2,900 m), SMF 81764–65 (3,000 m), Hacienda Taulis, ca. 6°50′S, 79°10′W: SMF 81754–57 (3,100 m), SMF 81758–62 (3,400 m).

Pristimantis rhabdolaemus: BOLIVIA: COCHABAMBA: 68.8 km SW Villa Tumari, 1,860 m: KU 183009; PERU: CUZCO: 7 km Santa Isabel, 1,900 m: KU 13887 (paratype); AYACUCHO: Huanhuachayocc, on Tambo trail: KU 175082–83 (paratypes); AYACUCHO: between Mitupucuru and Estero Ruana: KU 175084 (paratype); Toccate, montane forest next to the Río Chrurbamba, 1,940–2,000 m: MHNSM 18505–08; CUZCO: Huyro, 1,720 m: KU 175086–88.

Pristimantis simonbolivari: ECUADOR: BOLÍVAR: Bosque Protector Cashca Totoras, 3,000 m: KU 218252–56 (paratypes).

Pristimantis simonsii: PERU: CAJAMARCA: 23 km SW Celendin: KU 181357–59, 181360; 33 km SW Celendin: KU 181361–389.

Pristimantis stictoboubonus: PERU: SAN MARTÍN: Quintecocha, 3,130 m: MHNSM 24446 (holotype), MHNSM 24445 (paratype); Ullilen, 3,000 m: MHNSM 24447 (paratype).

Pristimantis vidua: ECUADOR: ZAMORA-CHINCHIPE: 15 km E Loja, 2,800 m: KU 120082 (holotype), 120083–88 (paratypes), 120090–91 (paratypes); AZUAY: 32 km S Cumbe, 3,180 m: KU 165652.

Phrynopus bagrecito: PERU: CUSCO: Río Marcapata, below Marcapata, ca. 2,740 m: KU 196512 (holotype), KU 196513–18, 196520–21, 196523–25 (all paratypes); Hacienda Huyro between Huayopata and Quillabamba, 1,830 m: KU 196527–28.

Phrynopus boettgeri: PERU: PUNO: Phara, 3,466 m: MHNSM 19966 (holotype), MHNSM 19967–76, MTD 46508–9, 46512–19 (paratypes).

Phrynopus bracki: PERU: PASCO: Parque de la Nación Yanachaga-Chemillén, 2,600 m: MHNJP 4400 (paratype); Parque de la Nacion Yanachaga-Chemillén: San Alberto: MHNSM 19906–08, MTD 45946–49.

Phrynopus bufoides: PERU: PASCO: La Victoria, 4,100 m: MHNSM 18074 (holotype), MHNSM 18066, MTD 45072 (paratypes).

Phrynopus cophites: PERU: CUSCO: S slope Abra Acanacu, 14 km NNE Paucartambo, 3,400 m: KU 138884 (holotype); N slope Abra Acanacu, 27 km NNE Paucartambo, 3,450 m: KU 138885–908, 138911–5 (all paratypes).

Phrynopus dagmarae: PERU: HUÁNUCO: Palma Pampa, 3,020 m: MHNSM 20451 (holotype), MTD 45932–34.

Phrynopus heimorum: PERU: HUÁNUCO: ±10 km E Conchamarca, 3,420 m: MHNSM 20441 (holotype).

Phrynopus horstpauli: PERU: HUÁNUCO: about 10 km E of Conchamarca, 09°59′44″S, 76°09′40″W, 3,420 m: MTD 41754–57; Ichocan, Jatunloma—forest, 10°10.16′S, 76°07.20′W, 3,100 m: MTD 44333–39; near Laguna Gwenguay, 10°11.04′S, 76°05.7′W, 3770 m: MTD 44349; Santa Rosa/Yaurin, 09°59′58.2″S, 76°10′02.5″W, 3,250 m: MTD 45625–27.

Phrynopus montium: PERU: JUNÍN: Cascas, near Huasahuasi: MCZ 2258–61 (paratypes); Monaynioc, 72 km NE Tarma: KU 206649–50.

Phrynopus parkeri: PERU: PIURA: summit Cordillera between Chanchaque and Huancabamba, 3,100 m: KU 135278 (holotype), 135279–305 (paratypes), 135307–311 (paratypes); 26 km SW Huancabamba, ca. 3,050 m: KU 196581–91; El Tambo, 2,720 m: KU 219820; El Tambo, 31.5 km E Chanchaque: KU 181288–90; 24.3 km SW Huancabamba: KU 181292; 25.5 km SW Huancabamba: KU 181293–96; 29.3 km SW Huancabamba: KU 181297–303; 31 km SW Huancabamba: KU 181304–56; El Tambo, 31.5 km E Chanchaque: KU 181393; CAJAMARCA: San Ignacio: Santuario Nacional Tabaconas Namballe, Lagunas Arrebiatadas: MHNSM 19913–18, MTD 45953–59.

Phrynopus peruanus: PERU: JUNÍN: Puna of Maraynioc (11°21′35.2″S, 75°28′52.6″W), 3,825 m: MHNSM 19977–78, MTD 46801–02; Maraynioc: 45 mi NE Tarma: MCZ 24310–19.

Phrynopus peruvianus: PERU: CUSCO: N slope Abra Acanacu, 29 km NNE Paucartambo, 3,450 m: KU 138917; N slope Abra Acanacu, 27 km NNE Paucartambo, 3,450 m: KU 138919–24, KU 138929–35; Tres Cruces: KU 17325, KU 173327–29; Paucartambo: Kosnipata: Esperanza, 13°10.938′S, 71°35.257′W, 3,090 m: MTD 46371–72; N slope Abra Acanacu, 29 km NNE Paucartambo, 3,400 m: MTD 45021–22.

Phrynopus pesantesi: PERU: PASCO: Laguna Quimaccocha, 4,390 m: MHNSM 19857 (holotype), MHNSM 19858–60, MTD 45887–88, 45890–91 (paratypes).

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Redescription and Revision of Some Red-Pigmented *Bugula* Species

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REDESCRIPTION AND REVISION OF SOME RED-PIGMENTED *BUGULA* SPECIES

JUDITH E. WINSTON[1] AND ROBERT M. WOOLLACOTT[2]

ABSTRACT. In this study, we describe or redescribe nine species of red-pigmented aviculiferous *Bugula* and compare them with the type species of the genus, *Bugula neritina* (L.). The names *Bugula robusta* MacGillivray and *Bugula minima* (Waters) have both been used (often interchangeably) for red-pigmented aviculiferous *Bugula* specimens collected from localities ranging from Tasmania to the Red Sea. Our analysis indicates, however, that *Bugula robusta* is a cool-water species whose distribution appears to be limited to the southern Australian region, whereas *Bugula minima* is a warm-water species distributed from the Red Sea to the Indo-Pacific. These, as well as some of the other species for which these names have been used by various authors, are described and illustrated here from museum material. *Bugula providensis, Bugula miniatella, Bugula ceylonensis, Bugula robustoides, Bugula solorensis,* and *Bugula paternostrae* are described as new. The descriptions of *Bugula robusta, Bugula minima,* and *Bugula crosslandi* are revised.

INTRODUCTION

We began this project out of necessity. One of us (RMW) was studying the development of *Bugula neritina,* and during the project, another red-pigmented *Bugula* species, this one with avicularia, was found at Coconut Island, Oahu, Hawaii. Its development was studied as well. The Hawaiian aviculiferous species appeared most similar to either *Bugula minima* (Waters) 1909 from the Red Sea or *Bugula robusta* MacGillivray 1869 from Victoria, Australia, but the descriptions of the two species in the literature were so inconsistent that it was impossible to determine whether the Hawaiian material belonged to either species. Winston, meanwhile, was studying western Atlantic and Caribbean collections and was concerned because the *Bugula* species that Osburn (1914) and authors who followed him had recognized as *Bugula minima* (Waters) did not closely resemble the one available illustration of a Red Sea specimen. To resolve these related problems, we decided to look at as much material as we could locate under those two names in museum collections, including type material if possible. Many of the specimens we examined for this project consisted of a few branches or branch fragments mounted as whole mounts in resin on slides. Those specimens could not be used for study by scanning electron microscopy (SEM). Measurements and light photomicrographs were also difficult because of the limited transparency of the old slide preparations. Despite these difficulties, it soon became apparent that the two names had been used by a number of authors from localities around the world for material that, by modern standards, belongs to several distinct taxa. In this paper, we attempt to clarify the situation by redescribing and illustrating *B. minima* and *B. robusta* and describing as new species some of the other specimens that had been synonymized under one of those names.

Taxonomic History

Bugula neritina, type species of the genus *Bugula,* was one of the earliest bryozoans described (Linnaeus, 1758). Late 18th and 19th century marine expeditions

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and surveys discovered the species at many warm-temperate and tropical localities around the world. For example, in her *Synonymic Catalogue of Marine Bryozoa,* Eliza Jelly (1889) listed 30 references to the species. No doubt its distinctive dark red coloration, large, tufted, seaweedlike colony form, and apparent preference for shallow water were partially responsible for the abundance of records. However, its eurytopic physiology and fouling habit might also have favored its early anthropogenic introduction to many areas.

Despite its status as type species of the genus *Bugula, Bugula neritina* differs from other known members of the genus in lacking the pedunculate, bird's head avicularia characteristic of the group. Early bryozoan taxonomists did not recognize the significance of this difference. When Arthur Waters in his publication on bryozoans from the Red Sea (1909) described a red-colored *Bugula* with avicularia, he considered it merely a new variety of *neritina.* In his synonymy of variety *minima,* he included material from Australia and Manaar (Gulf of Ceylon), as well as the Red Sea. He listed specimens from geographically distant localities: Ball's Head, New South Wales; Mersa Makdah, Khor Dongola, and Agig Suraya, Red Sea; and Prison Island, Zanzibar Channel (Indian Ocean). Waters gave no indication that he considered any one specimen or locality more important than the others, although he illustrated material only from two of the Red Sea localities: Khor Dongola and Nersa [sic] Makdah.

Waters was followed by the influential bryozoan taxonomist Sidney F. Harmer of the British Museum, who carried out his work during the early part of the 20th century, a period when biologists had begun to realize the importance of variation within populations. Harmer considered bryozoan species capable of possessing a wide range of intraspecific variation in zooid morphology and size. As a consequence, in the three volumes of the *Polyzoa of the Siboga Expedition,* he often synonymized what are now recognized as several different species under a single name. In *Part II, Cheilostomata Anasca* (1926), Harmer placed all specimens of Waters' variety *minima,* as well as material from localities ranging from the Red Sea to the Java Sea, in synonymy under *Bugula robusta,* a species originally described in 1869 from Victoria, Australia, by P. H. MacGillivray. Harmer included all of the Siboga specimens he examined in *B. robusta,* although his illustrations and discussion indicate a large amount of variation even within that geographically more restricted collection.

In her 1939 paper "Notes on some cellularine Polyzoa," Anna B. Hastings, also of the British Museum, followed Harmer in considering Waters' material from Zanzibar to be *B. robusta,* going so far as to put additional labels to that effect on the backs of the slides she examined. She raised *B. minima* to specific level, making its type the Crossland-Waters specimen from Mersa Makdah, then housed in the University of Liverpool Museum. She also described a new species, *Bugula crosslandi* Hastings, 1939. Its type was a British Museum specimen from Abu Shaar, Red Sea, collected by Crossland, but in her synonymy and discussion, she also claimed one of Waters' Red Sea specimens (Waters' Khor Dongola specimen from the University of Liverpool Museum) and specimens from the Pacific coast of Panama as belonging to *B. minima.*

Working in both the tropical western Atlantic and eastern Pacific, Harmer's contemporary, Raymond C. Osburn, who shared Harmer's view of the degree of variation possible within bryozoan species, used the name *Bugula minima* for all red *Bugula* with avicularia that he found in collections from the Tortugas, Florida (1914), Puerto Rico (1940), and the Pacific coast of Costa Rica and the Gulf of Panama (1950).

METHODS

We examined specimens from the Bishop Museum, Honolulu, Hawaii; the Nat-

ural History Museum, London, England (British Museum); the Manchester Museum, Manchester, England; the Museum Victoria, Australia (old Royal Museum of Victoria); The Natural Museum of Natural History, Smithsonian Institution, Washington, D.C.; The Allan Hancock Foundation Bryozoan Collection, Santa Barbara Museum of Natural History, Santa Barbara, California; the Museum of Comparative Zoology at Harvard University, Cambridge, Massachusetts; and the Virginia Museum of Natural History, Martinsville, Virginia.

For morphometric comparison, the following measurements were made on selected colonies: zooid length (LZ); zooid width (WZ) measured at maximum width of zooid, usually at or near distal end; opesia length (Lopes) and opesia width (Wopes), the greatest length and width of the membranous area of the frontal wall; orifice length (LO, if possible); orifice width (WO); ovicell length (LOv); ovicell width (WOv, if ovicells present); avicularium length (Lav); and avicularium width (Wav). All measurements were made with the use of a Wild stereomicroscope with 20× oculars at 100× magnification. We also included the ratio of avicularian length to zooid width (Lav/WZ) suggested by Ryland (1960) as potentially useful in distinguishing *Bugula* taxa. For species with more than one size class of avicularia, the length of the large avicularia was used in determining this ratio. Table 1 gives the morphometric results for the colonies studied.

We also photographed colonies to show branch bifurcation type and morphology of zooids, ovicells, and avicularia. Because much of the material consisted of whole mount slide preparations, photography and measurement were sometimes difficult. For example, because of opacity of some of the old slides, measurement of zooid length had to be done from the frontal side, rather than the basal side as has been recommended for *Bugula* (Hayward and Ryland, 1998). For consistency, all measurements included in this study were taken from the frontal surface. Material of some species was available for SEM study. Those specimens are illustrated by SEM images, as well as light micrographs.

RESULTS

Cheilostome Morphology

Members of the order Cheilostomata are the dominant group of bryozoans in Recent seas. They are characterized by tubular to box-shaped zooids with variously calcified walls and an operculum, a hinged flap, usually with chitinous thickening, opening on the frontal surface for protrusion of the lophophore. They are also characterized by widespread occurrence of polymorphism, the development of various types of specialized heterozooids, in addition to the feeding autozooids.

Morphology of *Bugula* Species

Members of the genus *Bugula* produce erect branching colonies from an upright ancestrula. Colonies are attached by tubular rhizoids, kenozooidal heterozooids that develop from pore plates in frontal, lateral, and basal surfaces of autozooids and grow toward the substratum to anchor the colony. The branches are formed by two or more series of zooids that are wide distally and narrow proximally in shape, in frontal view looking subtriangular and in basal view showing forked proximal ends. Basal and lateral walls are lightly calcified, but most of the frontal wall is membranous, giving colony branches considerable flexibility. Unlike most other cheilostomes, the orifice is closed by a membranous flap rather than a reinforced operculum. The width of the opening may be visible on closed zooids, but its length usually cannot be determined accurately. Some species have spines on the distal angles of the zooids. At least some of the spines may be jointed, and therefore kenozooidal. Almost all species have motile pedunculate bird's head avicularia (Figs. 1A–C). The body of the avicularium zooid makes up the

TABLE 1. MORPHOMETRIC DATA FOR RED *BUGULA* SPECIES STUDIED.

Character measured (mm)	*B. neritina*	*B. minima*				*B. providensis*	*B. miniatella*	*B. crosslandi*	*B. ceylonensis*
	Hawaii[1]	Red Sea[2]	Hawaii (MCZ)[3]	Hawaii (BM)[4]	East Africa[5]	Seychelles[6]	Tortugas, Florida[7]	Red Sea[8]	Sri Lanka[9]
LZ	18	6	6	12	6	6	6	12	6
Mean	0.72	0.56	0.66	0.57	0.61	0.68	0.58	0.51	0.53
SD	0.03	0.06	0.04	0.06	0.09	0.07	0.05	0.04	0.03
Range	0.68–0.76	0.49–0.67	0.61–0.72	0.52–0.75	0.51–0.76	0.57–0.74	0.53–0.66	0.44–0.57	0.49–0.57
WZ	18	6	6	12	6	6	6	12	6
Mean	0.21	0.20	0.21	0.20	0.20	0.19	0.18	0.17	0.20
SD	0.002	0.001	0.01	0.01	0.02	0.02	0.02	0.02	0.02
Range	0.18–0.23	0.19–0.21	0.19–0.23	0.17–0.20	0.20–0.23	0.15–0.21	0.15–0.19	0.15–0.18	0.17–0.21
LO	—	—	—	—	—	—	6	2	—
Mean	—	—	—	—	—	—	0.07	0.05	—
SD	—	—	—	—	—	—	0.01	0.01	—
Range	—	—	—	—	—	—	0.06–0.10	0.05–0.06	—
WO	—	6	6	12	6	6	6	12	6
Mean	—	0.12	0.13	0.11	0.13	0.11	0.11	0.09	0.13
SD	—	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01
Range	—	0.11–0.13	0.11–0.15	0.10–0.13	0.11–0.13	0.10–0.13	0.10–0.13	0.07–0.11	0.11–0.13
Lopes	—	6	6	12	6	6	—[10]	12	6
Mean	—	0.43	0.50	0.52	0.51	0.51	—	0.37	0.43
SD	—	0.04	0.05	0.06	0.06	0.08	—	0.01	0.03
Range	—	0.38–0.48	0.42–0.57	0.46–0.64	0.46–0.59	0.40–0.57	—	0.35–0.39	0.42–0.49
Wopes	—	6	6	12	6	6	—[10]	12	6
Mean	—	0.15	0.16	0.17	0.15	0.16	—	0.15	0.17
SD	—	0.02	0.02	0.01	0.01	0.02	—	0.01	0.01
Range	—	0.13–0.17	0.13–0.17	0.15–0.18	0.13–0.17	0.13–0.17	—	0.13–0.18	0.15–0.19
LOv	18	2	6	6	6	6	6	12	5
Mean	0.21	0.20	0.24	0.20	0.23	0.20	0.19	0.17	0.22
SD	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01
Range	0.18–0.23	0.19–0.21	0.23–0.25	0.19–0.22	0.209–0.238	0.171–0.228	0.171–0.190	0.147–0.184	0.21–0.23
WOv	18	2	6	6	6	6	6	12	5
Mean	0.29	0.23	0.26	0.21	0.25	0.24	0.21	0.20	0.26
SD	0.02	—	0.01	0.02	0.01	0.01	0.01	0.01	0.02
Range	0.27–0.32	0.23	0.25–0.26	0.18–0.23	0.24–0.27	0.3–0.25	0.19–0.23	0.18–0.22	0.25–0.29
Lav1	—	6	6	12	6	6	6	12	6
Mean	—	0.24	0.28	0.22	0.24	0.27	0.22	0.15	0.26
SD	—	0.02	0.03	0.02	0.03	0.02	0.02	0.01	0.02
Range	—	0.21–0.257	0.25–0.32	0.18–0.25	0.21–0.29	0.25–0.29	0.19–0.25	0.13–0.17	0.23–0.29
Wav1	—	6	6	12	6	6	6	12	6
Mean	—	0.10	0.12	0.10	0.10	0.11	0.09	0.08	0.14
SD	—	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Range	—	0.09–0.11	0.11–0.14	0.09–0.13	0.08–0.11	0.95–0.11	0.08–0.10	0.07–0.09	0.11–0.15
Lav2	—	6	5	10	4	—	—	—	
Mean	—	0.46	0.52	0.46	0.39	—	—	—	
SD	—	0.06	0.10	0.06	0.07	—	—	—	
Range	—	0.380–0.532	0.399–0.665	0.294–0.515	0.323–0.475	—	—	—	
Wav2	—	5	6	10	4	—	—	—	
Mean	—	0.16	0.2	0.15	0.16	—	—	—	
SD	—	0.02	0.01	0.02	0.03	—	—	—	
Range	—	0.13–0.19	0.19–0.21	0.11–0.18	0.13–0.19	—	—	—	
Lav/WZ ratio	—	2.3	2.5	2.4	2.0	1.4	1.2	0.9	1.3

"head." Its distal edge is elongated into the rostrum, the upper "beak" of the bird's head shape. The lower "beak" is the mandible of the avicularium, homologous to the operculum of the autozooid. Most of the body cavity of the avicularium is filled by muscles, but a long-bristled polypide rudiment, or setiferous organ, is protruded through a central orifice in the frontal membrane. The base of the avicularium is attenuated into a peduncle, which is attached through a pore to a peduncle cush-

TABLE 1. EXTENDED.

Character measured (mm)	*B robusta*		*B. robustoides*		*B. solorensis*			*B. paternostrae*	
	Victoria, Australia[11]	Tasmania, Australia[12]	New South Wales, Australia[13]	New South Wales, Australia[14]	Zanzibar Channel[15]	Solor Island, Indonesia[16]	American Samoa[17]	Talaud Island, Indonesia[18]	Paternoster Island, Indonesia[19]
LZ	18	18	12	6	12	6	6	6	6
Mean	0.78	0.77	0.73	0.78	0.61	0.70	0.75	0.70	0.72
SD	0.03	0.05	0.04	0.03	0.05	0.05	0.02	0.03	0.02
Range	0.77–0.86	0.66–0.90	0.67–0.80	0.76–0.82	0.55–0.72	0.63–0.76	0.72–0.77	0.67–0.74	0.69–0.74
WZ	18	18	12	6	12	6	6	6	6
Mean	0.37	0.37	0.27	0.33	0.29	0.26	0.26	0.37	0.29
SD	0.05	0.06	0.02	0.03	0.01	0.02	0.03	0.04	0.02
Range	0.29–0.49	0.24–0.52	0.23–0.32	0.30–0.38	0.26–0.31	0.25–0.29	0.22–0.31	0.32–0.42	0.26–0.32
LO	18	18	6	6	—	—	6	6	1
Mean	0.08	0.08	0.07	0.07	—	—	0.07	0.29	0.07
SD	0.01	0.01	0.01	0.02	—	—	0.01	0.01	—
Range	0.07–0.10	0.07–0.11	0.06–0.09	0.06–0.10	—	—	0.06–0.08	0.29–0.30	—
WO	18	18	12	6	11	6	6	6	6
Mean	0.16	0.18	0.31	0.14	0.15	0.13	0.13	0.24	0.16
SD	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.03
Range	0.13–0.19	0.15–0.24	0.11–0.17	0.13–0.15	0.13–0.28	0.114–0.13	0.11–0.15	0.22–0.25	0.13–0.20
Lopes	18	18	12	6	12	6	6	6	6
Mean	0.56	0.62	0.61	0.57	0.52	0.52	0.63	0.50	0.56
SD	0.04	0.08	0.05	0.03	0.05	0.05	0.01	0.02	0.03
Range	0.48–0.67	0.53–0.74	0.51–0.67	0.53–0.61	0.13–0.18	0.48–0.57	0.61–0.66	0.48–53	0.54–0.61
Wopes	18	18	12	6	12	6	6	6	6
Mean	0.24	0.28	0.21	0.23	0.24	0.22	0.22	0.30	0.23
SD	0.04	0.04	0.02	0.03	0.02	0.03	0.02	0.05	0.03
Range	0.17–0.34	0.22–0.36	0.19–0.24	0.19–0.26	0.22–0.28	0.25	0.18–0.24	0.23–0.34	0.19–0.26
LOv	8	—	12	6	6	6	6	—	6
Mean	0.34	—	0.31	0.27	0.25	0.24	0.23	—.	0.244
SD	0.03	—	0.02	0.02	0.02	0.02	0.01	—	0.03
Range	0.30–0.40	—	0.29–0.34	0.25–0.29	0.24–0.28	0.21–0.27	0.20–0.24	—	0.20–0.28
WOv	8	—	12	6	6	6	6	—	6
Mean	0.32	—	0.30	0.29	0.25	0.26	0.25	—	0.23
SD	0.04	—	0.02	0.01	0.02	0.02	0.01	—	0.04
Range	0.27–0.36	—	0.27–0.32	0.29–0.30	0.22–0.26	0.25–0.29	0.24–26	—	0.17–028
Lavl	13	18	12	6	12	6	6	6	6
Mean	0.43	0.40	0.33	0.33	0.37	0.38	0.33	0.27	0.29
SD	0.03	0.04	0.03	0.03	0.02	0.05	0.03	0.02	0.02
Range	0.38–0.44	0.28–0.46	0.29–0.38	0.29–0.36	0.33–0.40	0.32–0.47	0.28–0.35	0.25–0.29	0.28–0.32
Wavl	12	18	12	6	12	6	6	6	6
Mean	0.24	0.21	0.19	0.21	0.16	0.15	0.12	0.14	0.150
SD	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.01	0.02
Range	0.23–0.27	0.18–0.25	0.17–0.23	0.19–0.23	0.13–0.18	0.11–0.13	0.10–13	0.23–0.34	0.13–0.32
Lav/WZ ratio	1.2	1.1	1.3	1.2	1.3	1.5	1.3	0.73	1.0

[1] MCZ 100106. Waikiki Yacht Club, Oahu, Hawaii.
[2] NHM 1937.9.28.37. Ghardaqa, Red Sea.
[3] MCZ 100107. Coconut Island, Oahu, Hawaii.
[4] BKBM K1019. Barber's Point Harbor; K843. Honolulu Harbor, Oahu, Hawaii.
[5] NHM 1939.4.18.2. Dar-es-Salaam, Tanzania, Indian Ocean.
[6] NHM 1936.12.30.166. Providence Island, Seychelles, Indian Ocean.
[7] NMNH 208837 (need catalog number). Tortugas, Florida.
[8] NHM 1937.9.28.35. Abu Shaar, Red Sea.
[9] NHM 1899.7.1.4608. Ceylon.
[10] Could not see to measure in cleared, whole-mount specimen.
[11] MV F 91987 (63486). Victoria, Western Port; 63489. Victoria, location unknown; NHM 97.5.1.378.
[12] MV F 133121–133123. Tasmania, Australia.
[13] NHM 1888.1.2.2. Port Jackson, New South Wales, Australia.
[14] NHM 1883.11.29.24. Port Jackson, New South Wales, Australia.
[15] MM 1299. Zanzibar Channel, Zanzibar, Indian Ocean.
[16] NHM 1928.3.6.267. Solor Island, Indonesia.
[17] BKBM K1046. American Samoa.
[18] NHM 1928.3.6.268.
[19] NHM 1979.1.8.1. Paternoster Island, Indonesia.

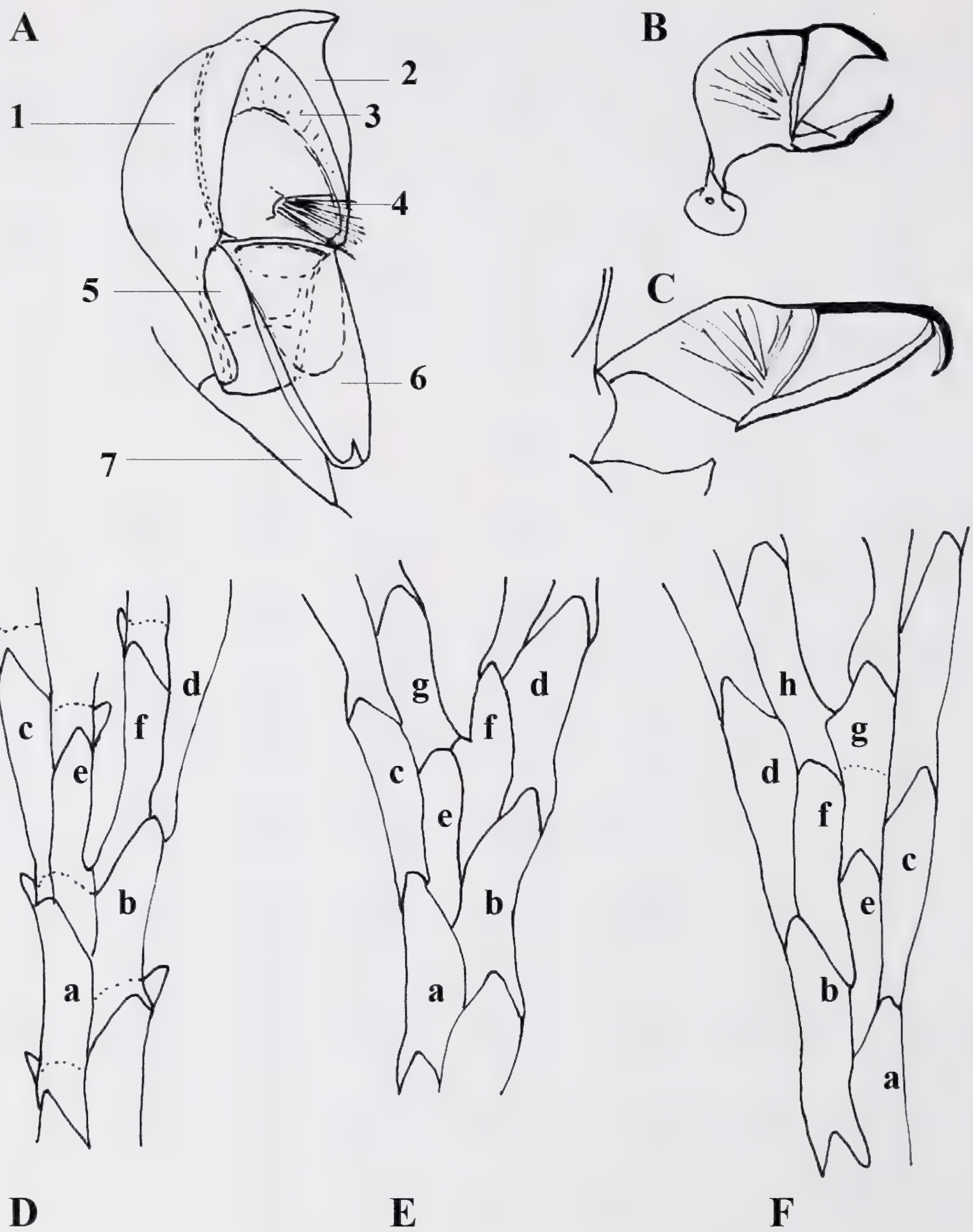

Figure 1. A. Structure of a pedunculate or "bird's head" avicularium: 1. Body of avicularian zooid = "head." 2. Rostrum of zooid = "beak." 3. Cryptocyst of avicularian zooid. 4. Sensory bristles of polypide rudiment. 5. Peduncle, elongate proximal portion of avicularian zooid. 6. Mandible = lower part of "beak." 7. Peduncle cushion. B. Round-headed avicularium in profile (A and B redrawn from Kauffmann, 1971). C. Elongate sway-backed avicularium in profile. D. Harmer's bifurcation type 3 in basal view. E. Bifurcation type 4 in basal view. F. Bifurcation type 5 in basal view (D, E, and F redrawn from Ryland, 1960).

ion, which is part of the wall of the supporting autozooid. Ovicells are hyperstomial, crescentic to globular, or helmet-shaped.

In biserial species such as those discussed here, patterns of branch bifurcation are usually one of three types: types 3, 4, and 5 of Harmer (1926) (Figs. 1D–F).

TAXONOMIC SECTION

Order Cheilostomata
Suborder Neocheilostomina d'Hondt, 1985 (part)
Infraorder Flustrina Smitt, 1868 (part)
Superfamily Buguloidea Gray, 1848
Family Bugulidae Gray, 1848

Genus *Bugula* Oken, 1815

Bugula neritina group

Bugula neritina (Linnaeus, 1758)
Figures 2, 3

Sertularia neritina Linnaeus, 1758: 815.
Bugula neritina Robertson, 1905: 266, pl. 9, fig. 47; pl. 16, fig. 97. Hastings, 1930: 704. Osburn, 1950: 154, pl. 23, fig. 3; pl. 24, fig. 3. Ryland and Hayward, 1977: 162, fig. 78. Winston, 1982: 129, fig. 52. Hayward, 1988: 289. Gordon and Mawatari, 1992: 21, pls. 2G, 5F. Hayward and Ryland, 1998: 220, fig. 68. Liu et al., 2001: 466, pl. 22, figs. 1, 2. Seo, 2005: 330, pls. 47–49. Tilbrook, 2006: 39, pl. 5C.

Description. Colonies consisting of erect, biserial, wine-red to red-brown branches, forming tufts up to 10 cm in length in some habitats. Large, about 0.72 mm in length, elongate zooids, about 0.21 mm wide distally, and tapering proximally, with frontal membrane covering almost entire frontal wall. Zooids with no distal spines, but with sharply pointed distal corners. Polypides large, red-pigmented, the mean tentacle number (of Florida specimens) 23, mean lophophore diameter 0.76 mm. No avicularia. Ovicells large and globular, attached to distal corners of zooids and oriented at a slight angle to branch axis. Reddish brown when filled with brooded embryos, becoming more calcified and pearly white in color as they age.

Diagnosis. No avicularia. Zooids large, colonies becoming large, ovicells globular.

Notes. Bugula neritina is likely the most widely studied of all bryozoans, having been the focus of investigations ranging from biogeographic occurrence, invasive biology, embryonic development, larval biology, and settlement and growth to inter- and intraspecific interactions. As is known to occur in all species of *Bugula* examined to date and is documented also in certain other cheilostomes, *B. neritina* possesses an extraembryonic nutrition system. A specialized lining of the ovicells is modified for the manufacture and transport of nutrients across the extracellular barrier of the ovicell lining to the developing embryo that resides within the lumen of the brood chamber (Woollacott and Zimmer, 1972, 1975). During development from egg to larva, an approximately 500-fold increase in volume occurs (Woollacott and Zimmer, 1975). Because the larva lacks a digestive tract, persistent blastocoel, or coelomic cavities, this increase in volume represents a direct increase in mass. The functional significance resides, in part, in increased provisioning of nutrients supporting duration of the larval swimming period, for transformations at metamorphosis until an ancestrula capable of feeding has developed, and for production of an ancestrula that is generally larger than observed in related species. Wendt (1996, 1998, 2000) has studied in detail the energetics of swimming and metamorphosis in this species.

Bugula neritina is of medical interest because of the activities of one of the natural products isolated from this species: bryostatin-1, a cyclic macrolactone (Pettit et al., 1982). This substance has been linked with action against a number of cancers by enhancing effectiveness of other anticancer drugs and reversing multidrug resistance, activation of T cells, immunomodulation and stimulation of hematopoietic progenitor cells, and possessing possible antidepressant and memory-enhancing effects (Kijoa and Sawangwong, 2004; Paul et al., 2007; Sharp et al., 2007a). Davidson and coworkers (2001) localized the site of its synthesis to symbiotic bacteria occurring in association with *B. neritina.* Woollacott (1980) described, on the basis of anatomy, the presence of bacteria in the pallial sinus of *B. neritina* larvae and noted that these bacteria are released like a cloud around the larva at the onset of metamorphosis, potentially providing a route for intraspecific vertical transmission as well as having roles in other possible intra- and interspecific interactions. Furthermore, Woollacott reported that whereas bacteria were also found in *B. simplex* larvae, they were not observed in larvae of *B. turrita,* a species that arises

Figure 2. *Bugula neritina.* Oahu, Hawaii. MCZ 100106. SEM images. A. Ovicelled branches. Scale bar = 200 μm. B. Branch of colony showing ovicelled and nonovicelled zooids. Scale bar = 200 μm. C. Basal side of branch showing bifurcation pattern. Scale bar = 200 μm. D. Two ovicells and adjacent nonovicelled zooid. Note small spiny projections on distal edges of zooids, but no jointed spines such as occur in many *Bugula* species. Scale bar = 100 μm.

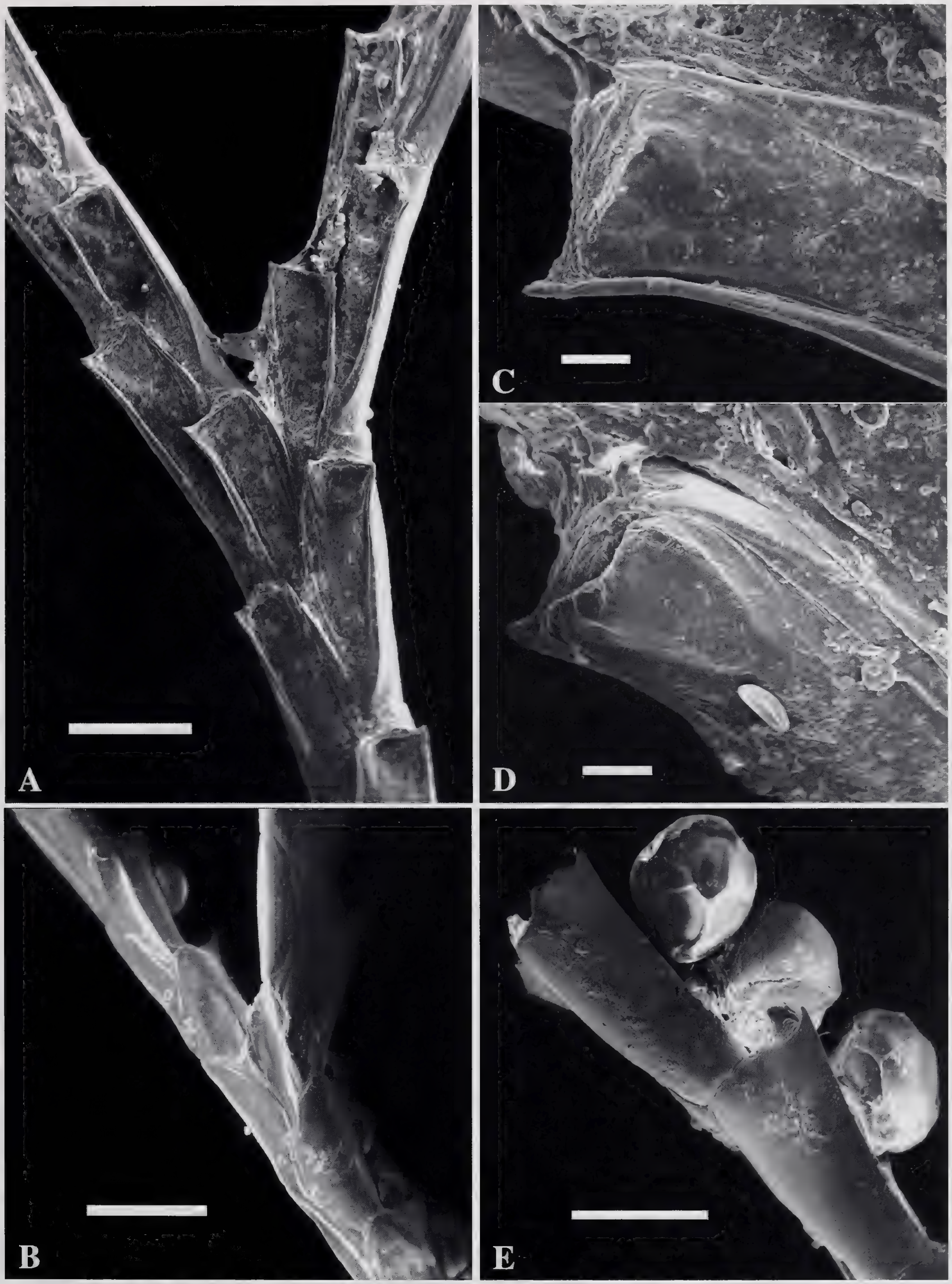

Figure 3. *Bugula neritina.* Bogue Sound, North Carolina, Atlantic Ocean. VMNH 210. SEM images. A. Front view of branch bifurcation. Scale bar = 400 μm. B. Back view of branches showing bifurcation pattern. Scale bar = 400 μm. C. Orifice, showing its liplike structure. Scale bar = 60 μm. D. A second, slightly gaping, orifice. Scale bar = 60 μm. E. Three ovicells at a branch tip, viewed from reverse side of branch. Scale bar = 200 μm.

in seasonal successional series after *B. simplex.* Woollacott and Zimmer (1975) also illustrated bacteria in association with the funicular cords of the autozooids in *B. neritina.* Koty Sharp and coworkers (2007b) provide a detailed account of localization of bryostatins through the life cycle of *B. neritina.*

A functional role for bryostatin in the life cycle of *B. neritina* is now well established (Lindquist and Hay, 1996; Lopanik et al., 2004, 2006; Sharp et al., 2007b). Bryostatins are unpalatable to certain species of fish and, thereby, deter predation on *B. neritina* larvae. High concentrations of bryostatins also exist in tissues of zooids near the distal tips of branches, which might reduce predation on these growing regions of colonies.

In this paper we have illustrated both Pacific and Atlantic material and presented a morphological description applicable to populations worldwide on the basis of the traditional view of *B. neritina* as a widespread, warm-water, fouling species. However, analysis of bryostatins found in populations from different localities or depths show variation in the kinds and amounts of several bryostatin compounds present, indicating that *B. neritina* could be a cryptic species complex, rather than a single species (Davidson and Haygood, 1999; McGovern and Hellberg, 2003).

Note that the synonymy given above is not a complete synonymy for *B. neritina* (which would take several pages). The references cited emphasize Indo-Pacific records or refer to additional taxonomic citations in their synonymies of the species.

Distribution. Bugula neritina sensu lato is one of the most widespread fouling bryozoans, occurring in tropical to temperate waters on both natural and artificial substrata.

Specimens Examined. MCZ 100106. *Bugula neritina,* floating docks, Waikiki Yacht Club, Ali Wai Basin, Oahu, Hawaii, 30 June 1992, R. M. Woollacott coll. MCZ 100108. *Bugula neritina,* Amelia Island, Florida, 1861, S. H. Scudder coll. MCZ 100109. *Bugula neritina,* Amelia Island, Florida, 1861, S. H. Scudder coll. MCZ 100110. *Bugula neritina,* Mussel Point, California, 36°37′20″N, 121°54′15″W, A. E. Blagg coll., 4 Apr. 1938. VMNH 210.00. *Bugula neritina,* Bogue Sound, Island Harbor Marina, Emerald Isle, North Carolina, Lynn Pritchett coll., 29 Aug. 1993. VMNH 701.00. *Bugula neritina,* Walton Rocks, South Hutchinson Island, St. Lucie County, Florida, 19 Feb. 1999, J. E. Winston coll. VMNH 852.00. *Bugula neritina,* south end of Wrightsville Beach, New Hanover County, North Carolina, 16 June 1999, J. E. Winston coll. VMNH 1683.00. *Bugula neritina,* Ocean Isle Beach, Ocean Isle, Brunswick Co., North Carolina (beach drift), 5 May 2000, C. Carter coll. VMNH 2563.00. *Bugula neritina,* Folly Beach, Charleston Co., South Carolina, 13 Apr. 1995, J. E. Winston coll.

Bugula minima group

Bugula minima (Waters, 1909)
Figures 4–7

Bugula neritina var. *minima* part Waters, 1909: 136, pl. 11, figs. 6, 7; Waters, 1913: 471.
Bugula neritina (L.), forma *minima* Waters part Marcus 1921: 1 (not fig. 1).
Bugula robusta part Harmer, 1926: 435, not *Bugula robusta* Macgillivray, 1869.
Bugula minima part Hastings, 1939: 334, text-figs. 276A, B, C.

Neotype. Bugula minima Waters Hastings. Seaward edge, outer reefs, Ghardaqa, Red Sea, LWS. 1933. Dr. C. Crossland. NHM 1937.9.28.37.

Description. Colony erect, biserial, long-branched feathery tufts. Branching pattern of Harmer's type 4. Color red-brown when living, pigmentation very similar to that of *B. neritina*; brown pigment remaining in both dry- and wet-preserved specimens. Zooids elongate, about 0.56–0.66 mm long, widest distally (about 0.20 mm) and tapering proximally, outer lateral walls straight. Outer distal corners pointed, inner distal edges angular to rounded. Lightly calcified, with frontal opesial membrane covering most of the frontal wall. Avicu-

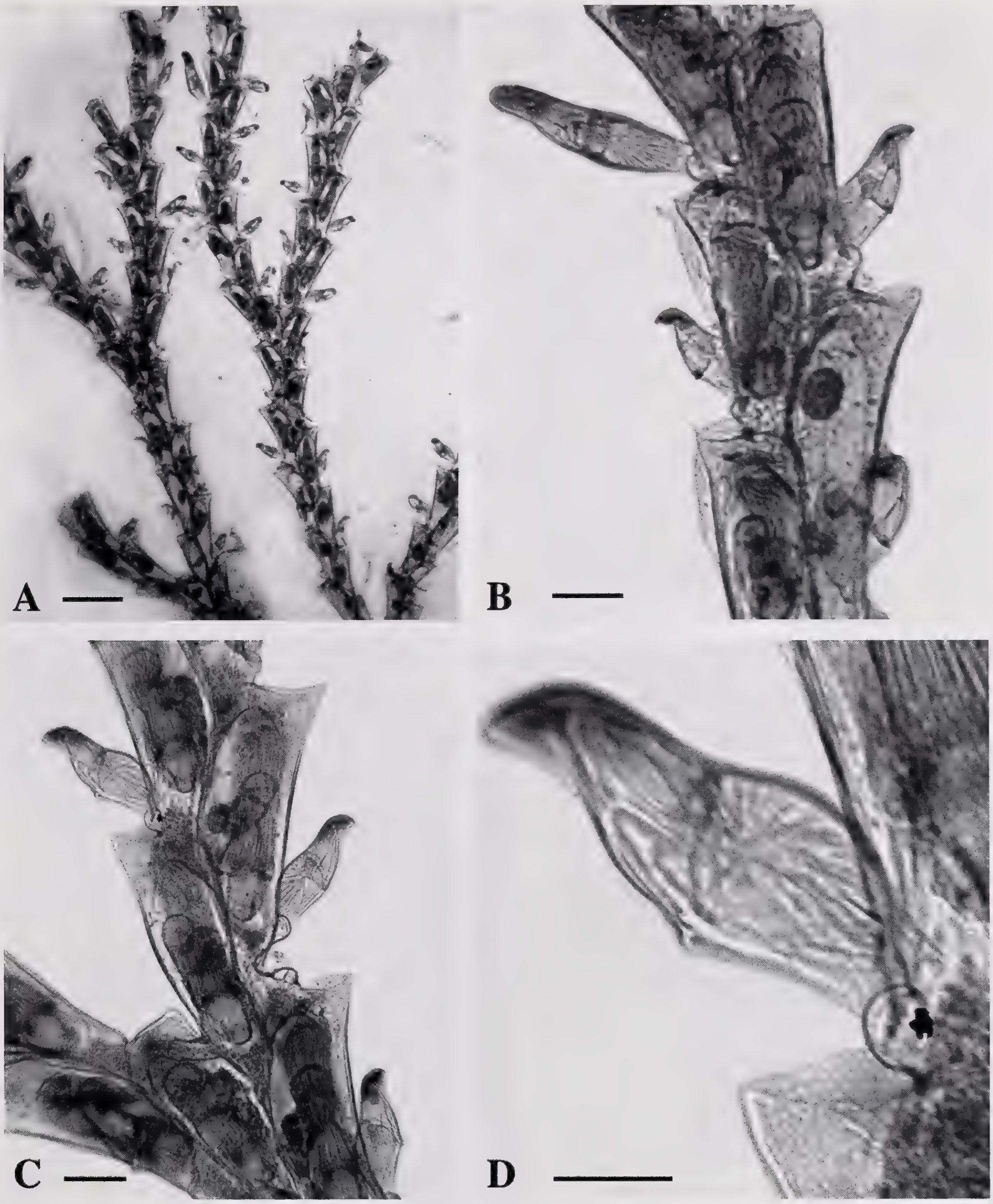

Figure 4. *Bugula minima.* Neotype. Light micrograph of whole mount on glass slide. Ghardaqa, Red Sea. NHM 1937.9.28.37. A. Colony branches, note small and large avicularia. Scale bar = 1 mm. B. Portion of branch showing several zooids with small and large avicularia. Scale bar = 100 μm. C. Back of branch showing bifurcation pattern. Scale bar = 100 μm. D. Close-up of an avicularium; note elongate head and dark pigmented tips of the elongate beak. Scale bar = 50 μm.

laria dimorphic, varying in size and shape. The smaller avicularia have rounded body and rostrum, but distinct, dorsally sway-backed appearance because of the curvature of both. The larger avicularia have a more elongated, sway-backed profile, with a diagonal line of cryptocyst demarcating the two sections. The inner body portion is elongate and shallowly convex dorsally; the outer portion a shorter, higher convexity with sharply down-curved beak, deeply pigmented at its tip. Avicularia are attached to a short peduncle cushion, which is positioned proximally on the outer side

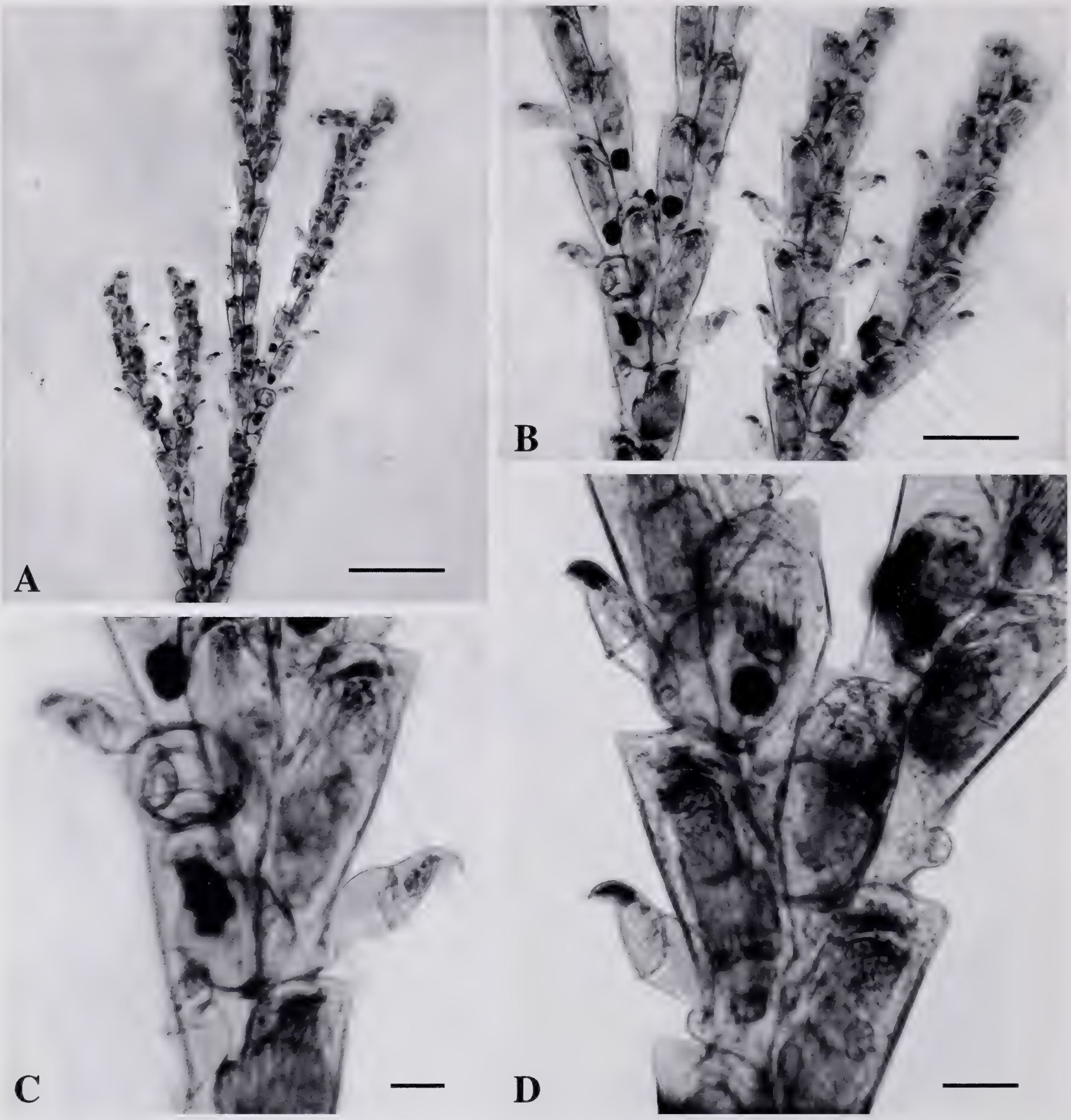

Figure 5. *Bugula minima.* Specimen from Dar-es-Salaam, Tanzania, Africa, Indian Ocean. NHM 1939.4.18.2. Light micrograph of whole mount on slide. A. Portion of branching colony fragment. Scale bar = 1 mm. B. Close-up of branches showing small and large avicularia; note elongate sway-backed shape and dark pigmented beak tip. Scale bar = 500 μm. C. Branch viewed from reverse side, showing zooids, one ovicell, and three avicularia. Scale bar = 100 μm. D. View of reverse side of colony showing bifurcation pattern. Scale bar = 100 μm.

of the zooid at about the level of the proximal edge of the frontal membrane. Ovicells are globular, attached at the inner distal angle of zooids, and oriented more or less horizontally. As they mature, they develop a broad, thickened outer band. Brown embryos could still be seen in the slide preparations examined.

Diagnosis. Colonies and zooids large, ovicells globular, avicularia dimorphic, both small and large avicularia sway-backed, large avicularia very elongate, attached by short peduncles to outer sides of zooids at the level of the base of the frontal membrane.

Notes. One of our goals was to find the

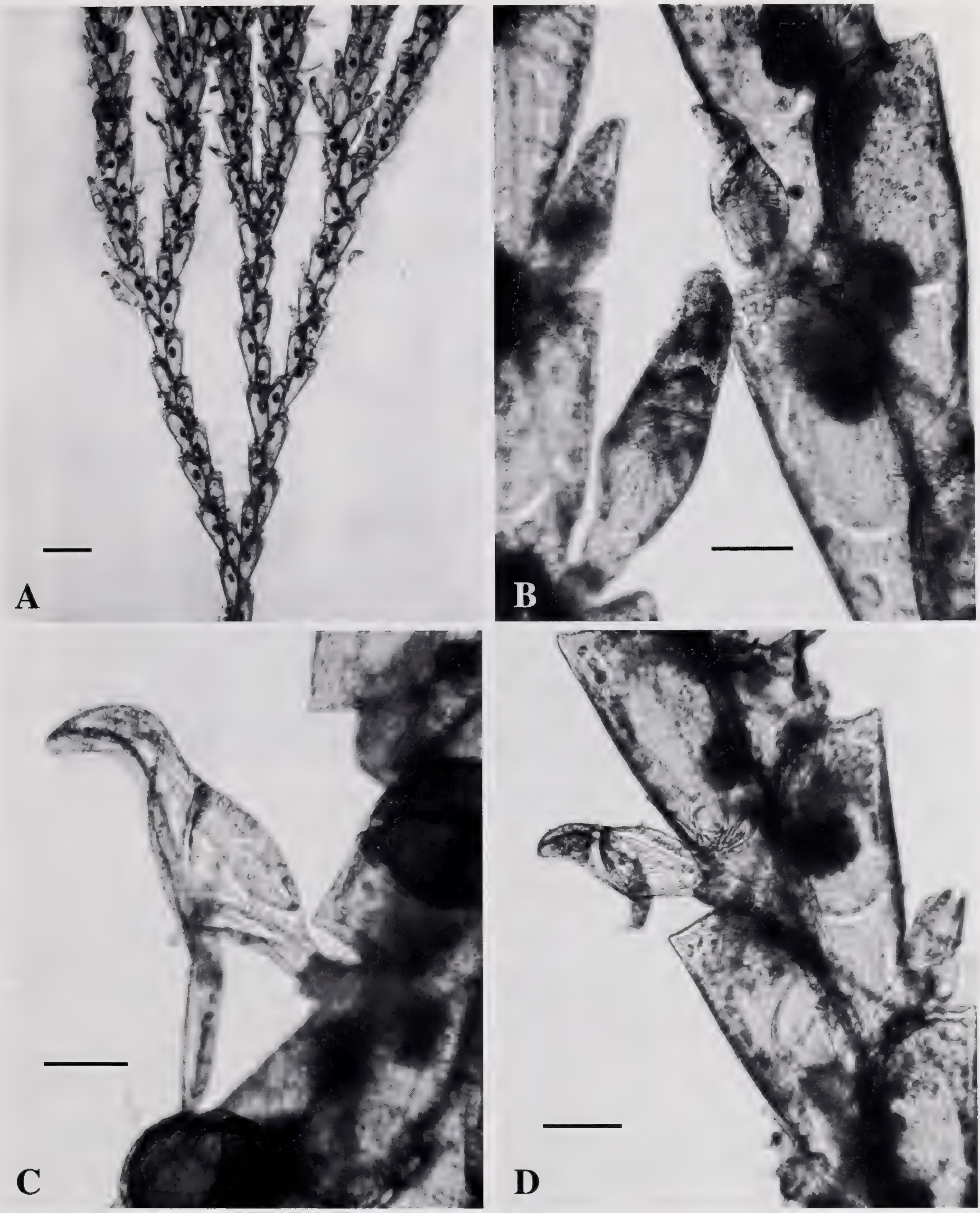

Figure 6. *Bugula minima.* Oahu, Hawaii. MCZ 100107. Light micrograph of wet-preserved specimen. A. Colony branches. Scale bar = 500 μm. B. Close-up of branches showing zooids and a large avicularium. Scale bar = 100 μm. C. Large avicularium with open mandible. Scale bar = 100 μm. D. Zooids and small avicularium. Scale bar = 100 μm.

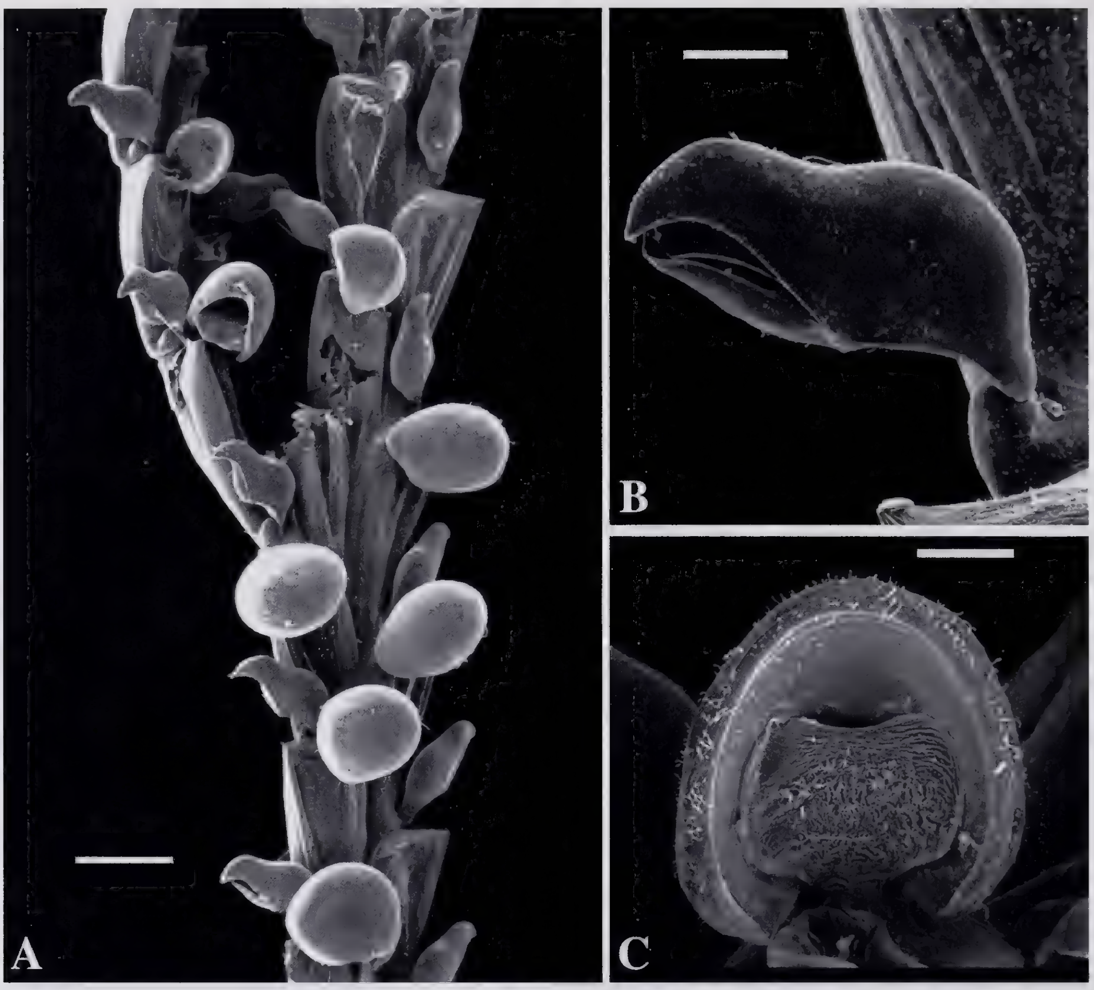

Figure 7. *Bugula minima.* Oahu, Hawaii. MCZ 100107. SEM images. A. Ovicelled colony branch showing zooids and avicularia. Scale bar = 200 μm. B. One of the elongate avicularia in side view. Scale bar = 50 μm. C. Developing ovicell. Scale bar = 25 μm.

original Red Sea and Indian Ocean material studied by Waters. Bryozoologists had believed for years that all of Waters' specimens, including type material, had been lost in bombing during World War II, but this was not the case. Thanks to the assistance of Henry McGhie and Rebecca Smith at the Manchester Museum, we were able to obtain three slides of Waters' material from Zanzibar. However, it did not include any type material. Hastings (1939) had designated a specimen she had borrowed from the Liverpool University Zoology Museum (Mersa Makdah, Red Sea, 5 fathoms, Waters) the type of *B. minima.* Thanks to Ian Wallace at the Liverpool Museum, we learned that the specimens from the Crossland collection, including the *B. minima* type, apparently remained in the Zoology Museum until the early 1960s when the university discarded its collections. A copy of a typed list of material that was in the University Museum's collection 1938/1939, created by Kathleen Carpenter and received from Ian Wallace, lists five slides of *B. minima.* Becaue the type of *B. minima* designated by Hastings no longer exists and we know of no topotypic specimens, we here designate the British Museum specimen from el-Ghardaqa, Red Sea, Egypt (NHM 1937.9.28.37), as neotype. As Figure 5 shows, one other specimen she listed as *B. minima,* NHM 1939.4.18.2 from Dar-es-Salaam (on the opposite side of the Zanzibar channel from Waters' location), clearly belongs in *B. minima.* Other specimens she included in *minima,* those from Provi-

dence Island and Ceylon, represent two different unnamed species and will be described below.

The Hawaiian specimens collected by Woollacott are very similar in zooid size to *B. minima* specimens from the Red Sea and East Africa–Zanzibar Indian Ocean localities and are included here (Figs. 6, 7). The avicularia of the Hawaiian colonies show a more extreme range in size: the large ones are larger, the outer lateral edges of zooids straighter than those of the Red Sea specimen, in particular, and the peduncles of the avicularia might be slightly more proximally attached. Several Honolulu-area specimens loaned by the Bishop Museum (see Specimens Examined) also match the MCZ Hawaiian *B. minima.*

Distribution. Red Sea, Indian Ocean, Hawaii.

Specimens Examined. NHM 1937.9.28. 37. *Bugula minima,* Waters Hastings, Seaward edge, outer reefs, Ghardaqa, Red Sea, LWS, 1933, Dr. C. Crossland. MM 1299. *Bugula neritina* var. *minima,* Ras Orowamnibe, Zanzibar Channel, 10 fathoms. Crossland Exp. 515 (E. collection A. W. Waters). MM 1300. *Bugula neritina* var. *minima,* mandibles, Prison Island, Zanzibar Channel, 8 fathoms. Crossland Exp. 505 (E. collection A. W. Waters). MM 1301. *Bugula neritina* var. *minima,* Prison Island, Zanzibar Channel, 8 fathoms. Crossland Exp. 505 (E. collection A. W. Waters). NHM 1939.4.18.2. *Bugula neritina* var. *minima,* Waters, Daressalam Stuhlmann Berlin Museum Part of 1944 [slide with whole mount, two cover slips, one has just a few avicularia under it], from Dar-es-Salaam, Tanzania (east Africa, Indian Ocean). MCZ. 100107. *Bugula minima,* Coconut Island, Oahu, Hawaii, Woollacott and Zimmer coll., 21 and 24 July 1995. BPBM K832. *Bugula robusta,* Oahu, Honolulu Harbor, Station 5. BPBM K843. *Bugula robusta,* Oahu, Honolulu Harbor, Station 8. BPBM K832. *Bugula robusta,* Oahu, Honolulu Harbor, Station 11. BPBM K1019. *Bugula robusta,* Oahu, Barbers Point Harbor Station 30.

Bugula providensis new species
Figure 8

Bugula neritina var. *minima* Thornely, 1912: 141.
Bugula minima (part) Hastings, 1939: 334.

Holotype. NHM.1936.12.30.166. *Bugula neritina* var. *minima.* Miss L. R. Thornely. Providence Is. 50–78f.

Etymology. Named after the location where the specimen was collected, near Providence Island, 9°14′S, 51°03′E, one of the Farquar group in the Outer Islands of the Seychelles, Indian Ocean.

Description. Colony composed of erect biserial branches, brownish red in color. Zooids elongate (about 0.68 mm long by 0.19 mm wide), sub-triangular, without spines. Avicularia are large and sway-backed, with long strongly hooked beaks, similar in shape to those of *B. minima,* but all similar in size, about 0.27 mm long by 0.11 mm wide, comparable in size to the large avicularia of *B. minima,* but differing in their position and orientation. The peduncle of the avicularium is attached to a peduncle cushion at the proximal edge of the zooid, almost on the outer lateral wall, not at the very base of the zooid, but up about the width of the pedicel from its proximal margin. Avicularia are oriented with beaks tilted diagonally outward, so that they stand out on either side of a branch in an evenly spaced feathery series. Ovicells are flattened, more ovoid than round. They are attached to inner distal corners of zooids and appear to droop and fill out as they mature.

Diagnosis. Avicularia monomorphic, sway-backed, elongate, similar to large avicularia of *B. minima* but with their attachment point on peduncle cushion about a peduncle width up from the proximal margin, close to lateral wall. Avicularia oriented diagonally, projecting featherlike from the branches.

Notes. This appears to be another species in the *minima* group. In addition to the sway-backed shape of the avicularia, the colony branches are delicate and flexible, like those of other *minima* species,

Figure 8. *Bugula providensis* new species. Light micrograph of holotype. NHM 1936.12.30.166. A. Branches of colony. Scale bar = 2 mm. B. Detached sway-backed avicularium. Scale bar = 200 μm. C. Basal view of branch showing bifurcation. Scale bar = 500 μm. D. Portion of branch to show ovicells and position of avicularia. Scale bar = 200 μm. E. Close-up of autozooids and avicularia. Scale bar = 200 μm.

rather than sturdy, as in those of the *robusta* group. Although only one specimen we examined belonged to this species, its morphology, especially the orientation of the avicularia, was distinct from all others. Thornely believed it to be Waters' "var. *minima*," apparently partly because the colonies of the specimens she examined were small, "1/2 inch in height growing on seaweed," and like many who followed, she interpreted Waters' name as meaning miniature in colony size. Hastings (1939) also considered Thornely's material to be *B. minima.*

Specimens Examined. Bugula neritina var. *minima,* Miss L. R. Thornely. Providence Is., 50–78f. NHM.1936.12.30.166. [Name crossed out and with second name pasted on label] *Bugula minima* Waters.

Distribution. Providence Island, Indian Ocean.

Bugula miniatella new species
Figure 9

Bugula neritina var. *minima* Osburn, 1914: 187. Not Waters, 1909: 136.

Holotype. Bugula minima Waters. USNM 537252. Tortugas, Florida, 8 fathoms, R. C. Osburn coll.

Etymology. Diminutive of *miniata,* Latin *miniatus,* bright red.

Description. Colony small, composed of erect biserial branches 1–2 cm in length, brownish red in color. Zooids elongate, about 0.58 mm long by 0.18 mm wide, sub-triangular, widest at distal end, tapering proximally. Both distal edges sharply pointed, although the points on outer sides of zooids may be more exaggerated. Zooids delicate, frontal membrane covering most of frontal wall. Avicularia all similar in size and shape, sway-backed and somewhat elongated, but with head and beak portions about equal in length. They are attached on a very short peduncle at the outer side of the proximal wall of the zooids, and tilted at a 45°–60° angle outward from the branches. Ovicells are almost spherical, 0.19 mm long by 0.02 mm wide, attached to inner edge of zooid, and with bottom margin parallel to distal edge of zooid. Ovicells developing on very short branches.

Diagnosis. Zooid size comparable to that of other red-pigmented species, but size of mature reproductive colonies very small. Ovicells spherical. Avicularia small, monomorphic, sway-backed, and somewhat elongate, attached at outer edges of proximal margins of zooids.

Notes. Osburn's description indicates that he found only one colony in his Tortugas collection, so the two slides in the NMNH are parts of a single holotype. The monomorphic avicularia are not as sway-backed as those of the Red Sea–Indo-Pacific *B. minima,* but the head section is not as rounded as that of *B. robusta* and most other *Bugula* species, making the avicularia more like those of *B. minima* in shape, but with a less elongate beak portion. Waters called his Red Sea species *B. minima* because the zooids were smaller in size than those of *B. neritina.* However, in the case of western Atlantic specimens, Osburn and others who followed him apparently took the name to mean small in colony size as well. This species is found on algae, sea grasses, and other ephemeral substrata. It attains only a small size and produces abundant ovicells along its short branches, indicating that it reproduces early in astogeny, in contrast to *B. minima,* which has a colony size comparable to that of *B. neritina,* but slightly smaller zooids.

Specimens Examined. Bugula minima Waters. USNM 537252. Tortugas, Florida, 8 fathoms, R. C. Osburn coll. [2 whole mounts on slides, taken from a single colony].

Distribution. Florida to the Caribbean.

Bugula crosslandi Hastings, 1939
Figure 10

Bugula neritina var. *minima* part Waters, 1909: 136, pl. 11, figs. 4, 5.

Bugula crosslandi part Hastings, 1939: 337 (text-fig. 276D; not text-fig. 277A).

Holotype. NHM 1937.9.28.35. Abu

Figure 9. *Bugula miniatella* new species. Holotype. NMNH 208837. Tortugas, Florida. Light micrograph of whole mount on glass slide. A. Branches of colony fragment. Scale bar = 1 mm. B. Closer view of branches showing zooids with ovoid to spherical ovicells and sway-backed avicularia. Scale bar = 250 μm. C. Close-up of branch; note elongate sway-backed avicularium with pigmented beak tip. Scale bar = 50 μm. D. Back view of branches showing bifurcation pattern. Scale bar = 100 μm.

Shaar, Red Sea, ½ to 1 fathom, 20 May 1933 (Dr. C. Crossland).

Description. Colony made up of short, delicate, biserial branches, light reddish brown in color, with type 4 branching, and long attachment rhizoids. Zooids elongate, about 0.51 mm long and 0.17 mm wide, widest distally, tapering proximally, then widening slightly at bases. Outer distal corners of zooids sharp-edged, but not extremely pointed, frontal membrane covering at least 75% of the frontal surface.

Avicularia small, monomorphic, attached on a short peduncle cushion at outer side of proximal gymnocyst, below proximal end of frontal membrane, but above proximal end of zooid. Avicularia with a rounded head and a narrow hooked beak. Ovicells attached at an angle to inner distal corner of zooids, subspherical, with a thickened band around the proximal margin.

Diagnosis. Colony size small, similar in size to that of *Bugula miniatella,* but avicularia round headed, with narrow hooked beaks and short peduncles inserted above the proximal margins of outer edges of zooids.

Notes. Osburn (1950) considered his material to belong to *B. minima.* However, the eastern Pacific material we examined appears to belong to Hastings "*Bugula crosslandi,*" as illustrated by the specimen from Gorgona, Panama (text-fig. 277A of Hastings [1939] and p. 704, pl. II, fig. 6), but not with her type material from the Red Sea. As Hastings (1939) noted in her remarks on *crosslandi,* eastern Pacific specimens differ from the type material of *crosslandi* from the Red Sea in having smaller and more slender avicularia. The eastern Pacific species is similar to Tortugas *miniatella,* as well as Red Sea *crosslandi,* in its small size at maturity, but probably should be named separately.

Specimens Examined. Red Sea Material. Because the Waters material from Khor Dongola that Hastings illustrated (her text-fig. 276D) was part of the Liverpool University Zoology Museum collection, which no longer exists, the only Red Sea material available for our examination was the type specimen, NHM 1937.9.28.35 *Bugula crosslandi* Hastings [originally labeled *Bugula neritina* var. *minima* Wat.], Abu Shaar, Red Sea, ½–1 fathom, Dr. C. Crossland. The material consists of two microscope slides and one jar of wet material (apparently that from which slides were made). **Eastern Pacific material.** Allan Hancock Foundation. *Bugula minima* (Waters). RCO. Cocos Island, Costa Rica, Hancock STA 779-38. "Drawn." *Bugula minima* (Waters). STA. 95. Panama. Galtsoff coll. (a good colony with ovicells). *Bugula minima* (Waters). Baja. Off S. end Tiburon. Allan Hancock Foundation. STA 1631 (clump with rootlets, and short branches with ovicells).

Distribution. Red Sea.

Bugula robusta group

Bugula robusta MacGillivray, 1869
Figures 11, 12

Bugula robusta MacGillivray, 1869: 129; MacGillivray in McCoy, 1881: 29, pl. 78, fig. 1.

Holotype. Bugula robusta MacGillivray, 1869. MV F 45556. Victoria, loc. unknown.

Description. Colonies composed of erect, biserial branches, purple when living, gray-brown when dry. Large zooids, about 0.78 mm long by 0.37 mm wide, with more strongly calcified lateral walls than those of other species studied here, their edges appearing whitish and thickened, especially on distal rims and in basal view. Zooids have inner distal edges rounded, outer distal edges tapering to a blunt conical point. Zooid shape broadly triangular, ratio of greatest length to width about 2:1. Orifice D-shaped with chitinous reinforcement, more noticeable than those of other *Bugula* species; golden yellow in color. Frontal membrane shorter proportionally than in other species. Avicularia have large rounded heads and short, narrow, down-curved beaks. They are attached to short peduncle cushions located on the outer proximal edges of the zooids. Ovicells slightly greater in length than width, attached at an angle to distal corner of zooids.

Diagnosis. Living colonies purple, walls white rimmed, well-calcified, with D-shaped operculum. Avicularia not elongated, with round heads and short beaks, attached on a short peduncle to outer proximal edges of zooids. Ovicells slightly longer than wide.

Notes. The specimens from Victoria match MacGillivray's original description

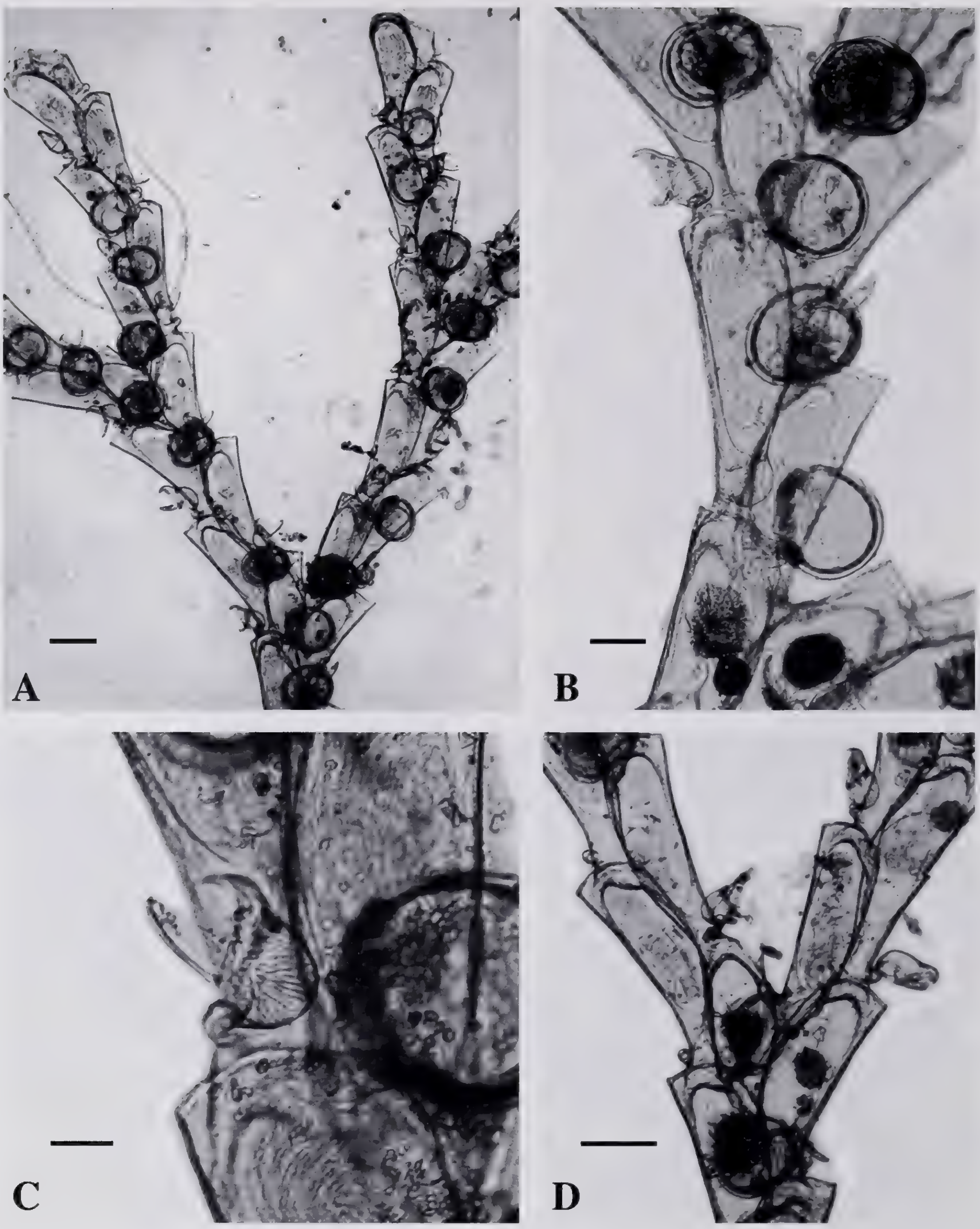

Figure 10. *Bugula crosslandi.* Holotype. NHM 1937.9.28.35. Abu Shaar, Red Sea. Light micrograph of whole mount on slide. A. Ovicelled branches of colony. Scale bar = 200 μm. B. Branch showing several zooids with ovicells and avicularia. Scale bar = 100 μm. C. Close-up showing one round-headed avicularium with open mandible. Scale bar = 50 μm. D. Reverse side of branch showing bifurcation pattern and position of several avicularia. Scale bar = 200 μm.

and his illustration in the *Prodromus.* Like most workers at the time, MacGillivray did not designate types. However, collections staff at Museum Victoria have identified one specimen as that likely to have been used in the original description. The putative type specimen is heavily encrusted with white calcareous material, some distal edges are also thickened by calcification, as is apparent in the illustration of *B. robusta* in plate 78, figure 1, of McCoy's *Prodromus of the Zoology of Victoria* (1881). Some question remains about the coloration of the species in life. MacGillivray states that it is of "greyish brown" color, not red or purple. This is true for dry material, but an underwater photograph of a living South Australian colony

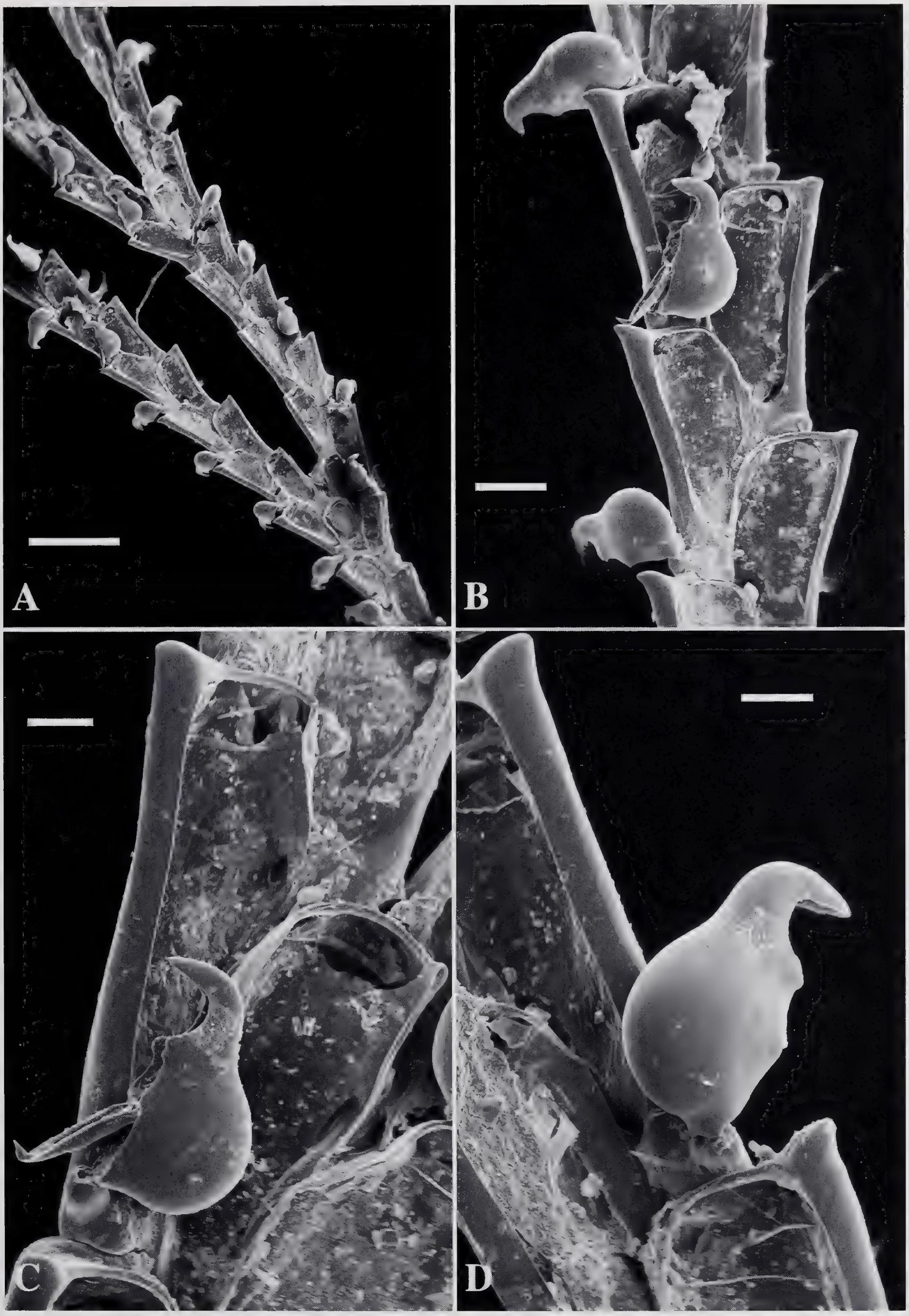

Figure 11. *Bugula robusta.* Tasmania, Australia. MV F 133123. SEM images. A. Colony branches. Scale bar = 1 mm. B. Branch showing zooids and avicularia; note opercula with reinforced rims and thick calcified walls of zooids. Scale bar = 200 μm. C. Two zooids and round-headed avicularium with sharply hooked beak tip and open mandible. Scale bar = 100 μm. D. Second avicularium with closed mandible, note strongly calcified outer walls of zooid. Scale bar = 100 μm.

Figure 12. *Bugula robusta.* Tasmania. SEM and light microscope images. SEM: A. Abfrontal side of branch, showing bifurcation pattern. Scale bar = 200 μm. B. Close-up of abfrontal side of branch, showing zig-zag patterning of adjoining walls. Scale bar = 100 μm. C. Close-up of operculum of one zooid and position of peduncle of distal zooid on its outer proximal frontal wall. Scale bar = 50 μm. Light micrographs: D. Back view of radicles and zooids near base of a colony. Scale bar = 100 μm. E. Another view of colony base showing thick bundle of attachment radicles. Scale bar = 100 μm.

by Karen Gowlett-Holmes (1999) shows it to have robust, curving, purple and orange-brown branches with distinct white rims. The distribution of actual *B. robusta* appears to be limited to cool-water habitats in southern Australia and Tasmania. Tropical records of the species are highly suspect, although completely understandable given that Harmer lumped many specimens from different localities under the *Bugula robusta* name in his 1926 Siboga Expedition report and illustrated at least three different species, none of them *B. robusta,* as that species.

Specimens Examined. Bugula robusta MacGillivray, 1869. MV F 45556. Loc. unknown. Vic., one microslide? Holotype. (five branches, avicularia, no ovicells). *Bugula robusta* MacGillivray, 1869. MV F 91986. Loc. unknown, Vic., one microslide. J. Bracebridge Wilson. (two fragments, encrusted, avic., no ovicells). *Bugula robusta* (M under the *Bugula robusta* name) MacGillivray, 1869. MV F 91987. Loc. Western Port, Vic., one microslide. J. B. Wilson MacGillivray coll. *Bugula robusta* MacGillivray, 1869. MV F 91988. Loc. Port Phillip Heads, Vic., one microslide. (one large and two smaller fragments, very debris-encrusted; avicularia gone, no ovicells). *Bugula robusta* MacGillivray, 1869. MV F 91989. Loc. Port Phillip Heads, Vic., one microslide also one large and some smaller fragments. MV F 133121. *Bugula robusta.* Australia, Tasmania, near Burial Point, Southport, 43°25′S, 146°58′E, A. Blackman coll., 1983. Identified by Phillip E. Bock, 1 May 2007. MV F 133122. *Bugula robusta.* Australia, Tasmania, near Tinderbox, d'Entrecasteaux Channel, 4303′S, 147°19′E. A. Blackman coll., 1983. Identified by Phillip E. Bock, 1 May 2007. MV F 133123. *Bugula robusta.* Australia, Tasmania, *Bugula robusta,* Australia, Tasmania, Spring Beach, Orford, 42°34′S, 147°54′E, A. Blackman coll., 1983. Identified by Phillip E. Bock, 1 May 2007.

Distribution. Victoria, South Australia and Tasmania, Australia.

Bugula ceylonensis new species
Figure 13

Holotype. Bugula minima. NHM, Busk Collection, 1899.7.1.4608. Ceylon, 7–10 fathoms. Holdsworth.

Etymology. Named after the location where the type specimen was collected, then known as Ceylon, now Sri Lanka.

Description. Colony erect, consisting of robust biserial branches, brown-pigmented when dry. Zooids broadly sub-triangular in appearance, shorter than those of preceding species, about 0.53 mm long by 0.20 mm wide. Frontal membrane extending almost to base of zooid. In dry specimens, the basal and lateral walls curve strongly around the frontal membrane. Avicularia are large, round-headed, all of similar size, and positioned in a central proximal location on a knoblike peduncle cushion. Ovicells smaller and more hemispherical than those of *B. minima,* attached at a sharp angle to the inner distal corner of zooids.

Diagnosis. Zooids shorter than those of *B. robusta.* Avicularia monomorphic, large, round headed, attached at a centro-proximal position on a knoblike peduncle. Ovicells almost hemispherical.

Notes. This specimen was included by Hastings (1939) in *B. minima,* although it lacked two types of avicularia. The position of the avicularia, as well as the sizes and shapes of zooids and ovicells also differ from those of *B. minima.* Thornely (1905: 109) lists a *B. neritina* with avicularia from Ceylon but gives no illustration and a very minimal description.

Specimens Examined. Bugula minima. NHM, Busk Collection, 1899.7.1.4608. Ceylon, 7–10 fathoms. Holdsworth [originally labeled *Bugula robusta*; the *robusta* is crossed out and a separate label with *Bugula minima* is pasted on the slide].

Distribution. Sri Lanka (Ceylon).

Bugula robustoides new species
Figure 14

Holotype. NHM 1879.5.27.1. *Bugula robusta* Port Jackson, Sydney Harbor, New South Wales, Australia.

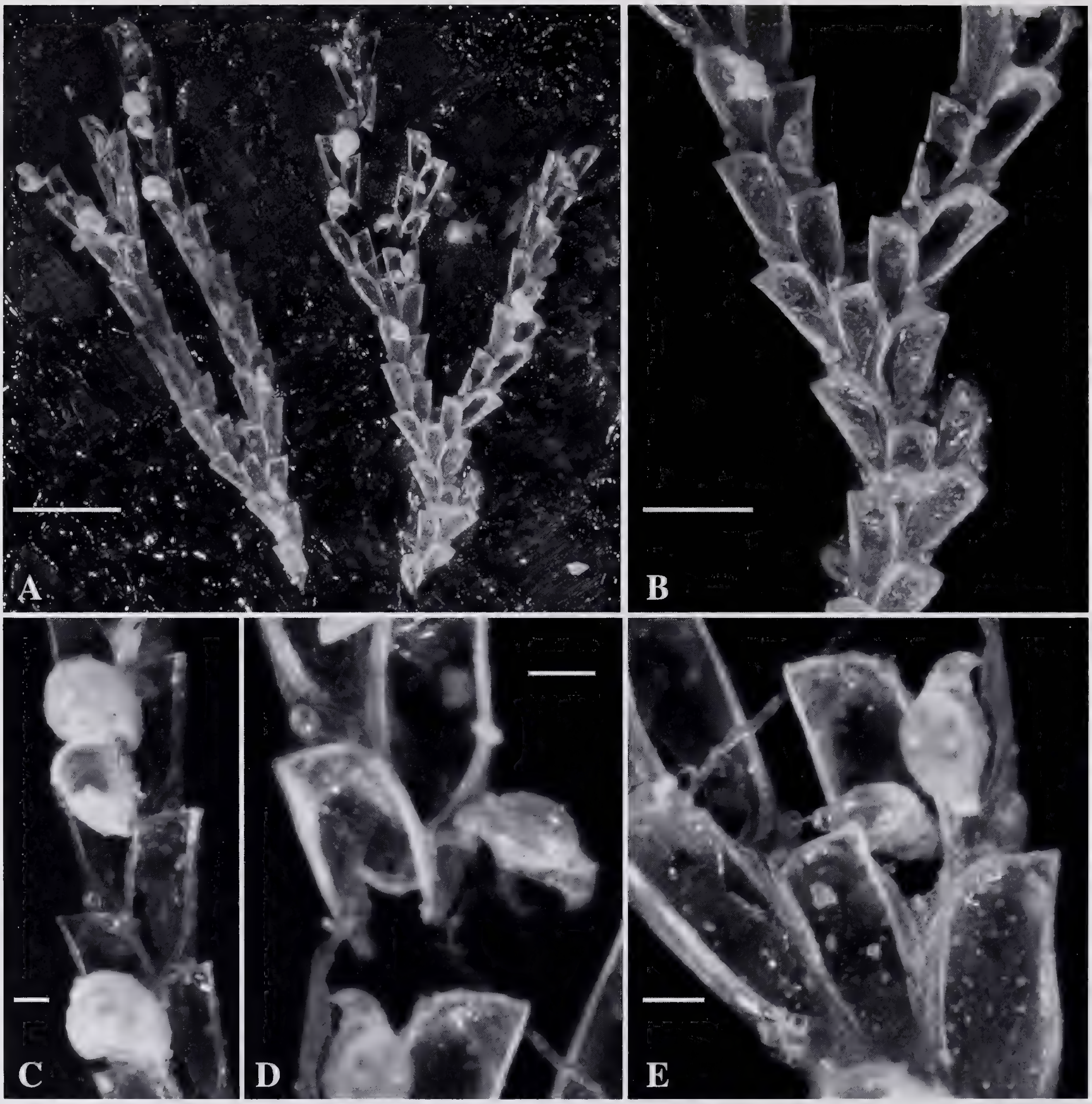

Figure 13. *Bugula ceylonensis* new species. Holotype. NHM 1899.7.1.4608. Ceylon. Light micrograph of dried colony glued on wooden slide. A. The two branch fragments of the holotype specimen. Scale bar = 1 mm. B. Front view of bifurcation; note zooid shape. Scale bar = 200 μm. C. Ovicelled zooids. Scale bar = 100 μm. D. Round-headed avicularium with open mandible. Scale bar = 100 μm. E. Zooids and two more avicularia. Scale bar = 100 μm.

Etymology. From the Latin ending *-oides,* like, resembling = *robusta*-like.

Description. Colony consisting of erect, biserial branches, brownish red in color. Zooids large, elongate, about 0.73–0.78 mm in length by 0.27–0.33 mm in width, widest distally, tapering somewhat proximally, but more rectangular in shape than those of other species described here. Outer distal angle of zooids sharply pointed, inner edge may be rounded or slightly pointed. Frontal membrane taking up more than three-quarters of frontal wall, but nonmembranous walls well chitinized and clearly visible in transmitted light. Orifice shape faintly visible, but no distinct

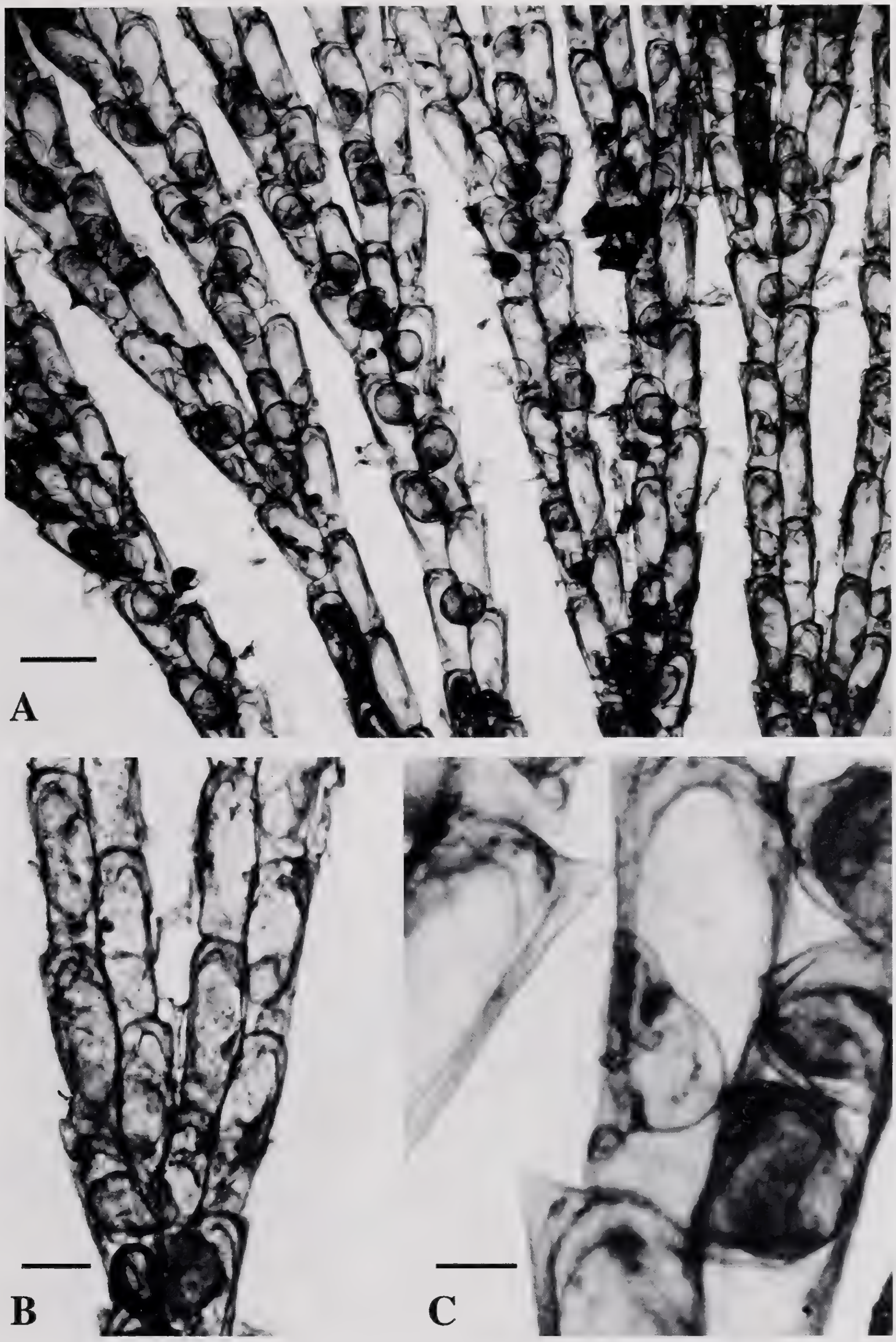

Figure 14. *Bugula robustoides* new species. Holotype. NHM 1879.5.27.1. Port Jackson, Sydney Harbor, New South Wales, Australia. Light micrographs of whole mount on slide. A. Colony branches, showing narrow, almost rectangular shape of zooids and numerous ovoid to spherical ovicells. Scale bar = 500 μm. B. Abfrontal view of branches, showing bifurcation pattern. Scale bar = 250 μm. C. Close-up of round-headed avicularium; note position of attachment. Scale bar = 100 μm.

operculum occurs. Avicularia monomorphic, of a more typical bird's head type, with a large rounded head region and a short down-curved beak and mandible. They are attached on a short round peduncle to the outer lateral margin of the zooids, a short distance above the proximal margin at the edge of the proximal end of the frontal membrane. Ovicells cup-shaped to globular, attached at the inner side of the distal margin of the zooid at an angle.

Diagnosis. The species differs from the Victorian *B. robusta* described by Mac-

Gillivray in coloration, more elongate subtriangular zooid shape, lower degree of calcification, more spherical ovicell shape, and lack of a well-chitinized operculum.

Notes. The New South Wales, Australia, specimens and specimens from Holothuria Bank, North West Australia, are considered to belong to this species, which might be found to be more widespread in the Indo-Pacific.

Specimens Examined. USNM 9485. *Bugula robusta.* Port Jackson (apparently from an exchange with NHM, originally part of NHM 1883.11.29.24). NHM 1879.5.27.1. *Bugula robusta.* Port Jackson. New South Wales, Australia. NHM 1883. 11.29.24. *Bugula robusta.* Port Jackson, New South Wales, Australia. NHM 1892. 1.28.60. *Bugula robusta* MacG., Holothuria Bank, North West Australia, [3°35′S, 126°E], 24–34 fathoms.

Distribution. Australia and perhaps other Indo–West Pacific localities.

Bugula solorensis new species
Figures 15–17

Bugula robusta part Harmer, 1926: 435, pl. XXXII, figure 2 only.

Holotype. NHM 1928.3.6.267. *Bugula robusta* MacGillivray, Siboga Expeditie Malay Archipelago Stat: 61. Reef. Lamakwera, Solor Id., E of Flores. Monograph xxviii, p. 435, no. 287A2.

Etymology. Named after the island where it was collected during the Siboga Expedition.

Description. Colony composed of erect, biserially branching tufts, dried specimens brown in color. Zooids elongate, about 0.61–75 mm long, slightly narrowed distally, their greatest width about 0.26–0.29 mm around the mid-region of the zooids, at which point they narrow sharply to the proximal ends. Distal rim of zooids with rounded inner corners and sharply pointed outer corners. Avicularia have round heads and long, very narrow beaks, hooked only at the extreme tips. Slight variations in avicularian size occur, but avicularia are not clearly dimorphic. The peduncle is long and inserted at the base of the opesia close to the outer proximal edge of the zooid. Ovicells broader at proximal edge, cup-shaped, with a broad proximal band, and attached at an angle to inner distal rim.

Diagnosis. Zooids elongate, greatest width at mid-section, then sharply tapering. Avicularia somewhat variable in size, with round heads and long, narrow beaks, hooked at very tips. Ovicells cup-shaped.

Notes. This specimen is the one illustrated as figure 1, pl. XXXII, of Harmer (1926).

Specimens Examined. Bugula robusta MacGillivray, Siboga Expeditie Malay Archipelago Stat: 61. Reef. Lamakwera, Solor Id., E of Flores. 1928.3.6.267. Monograph xxviii, p. 435, No. 287A2. *Bugula robusta* MacGillivray, Siboga Expeditie Malay Archipelago Stat: 313, 0–36 M 1928.3.6.274. Monograph xxviii, p. 435, No. 553A. *Bugula neritina* var. *minima.* Ras Orowamnibe, Zanzibar Channel, 10 fathoms. Crossland Expedition. 515. Manchester Museum 1299 [and on small label] E. A. W. Waters coll. H.1186. *Bugula robusta.* Tutuila, main dock, PPH, sta. 4, coll. 17 May 2007. BPBM K1046.

Distribution. Zanzibar. Reef off Solor Island, east of Flores, in Lesser Sunda Islands of Indonesia, American Samoa.

Bugula paternostrae new species
Figure 18

Bugula robusta part Harmer, 1926: 435, pl. XXXII, figures 1, 5, 6.

Holotype. NHM 1979.1.8.1. *Bugula robusta* MacGillivray, Siboga Expeditie Malay Archipelago Stat: 315 [Paternoster Island], N of Sumbawa, 0–36 m. Monograph xxviii, p. 435, No. 251C. 1928.3.6.268.

Etymology. Named for Paternoster Island, north of Sumbawa, Indonesia, where the holotype was collected.

Description. Colony composed of erect biserial branches. Zooids more triangular than those of other species studied here, giving branches a saw-toothed appearance.

Figure 15. *Bugula solorensis* new species. Waters' Zanzibar specimen. Light micrographs of whole mount on slide. A. View of branches of colony fragment. Scale bar = 1 mm. B. Colony branch showing more triangular shape of zooids, with scalloped distal rim, and long peduncles of round-headed avicularia, with elongate beaks. Scale bar = 100 μm. C. Abfrontal view of branch, showing bifurcation pattern. Scale bar = 250 μm. D. Close-up of several zooids, showing orientation and shape of ovicell and avicularia. Scale bar = 100 μm.

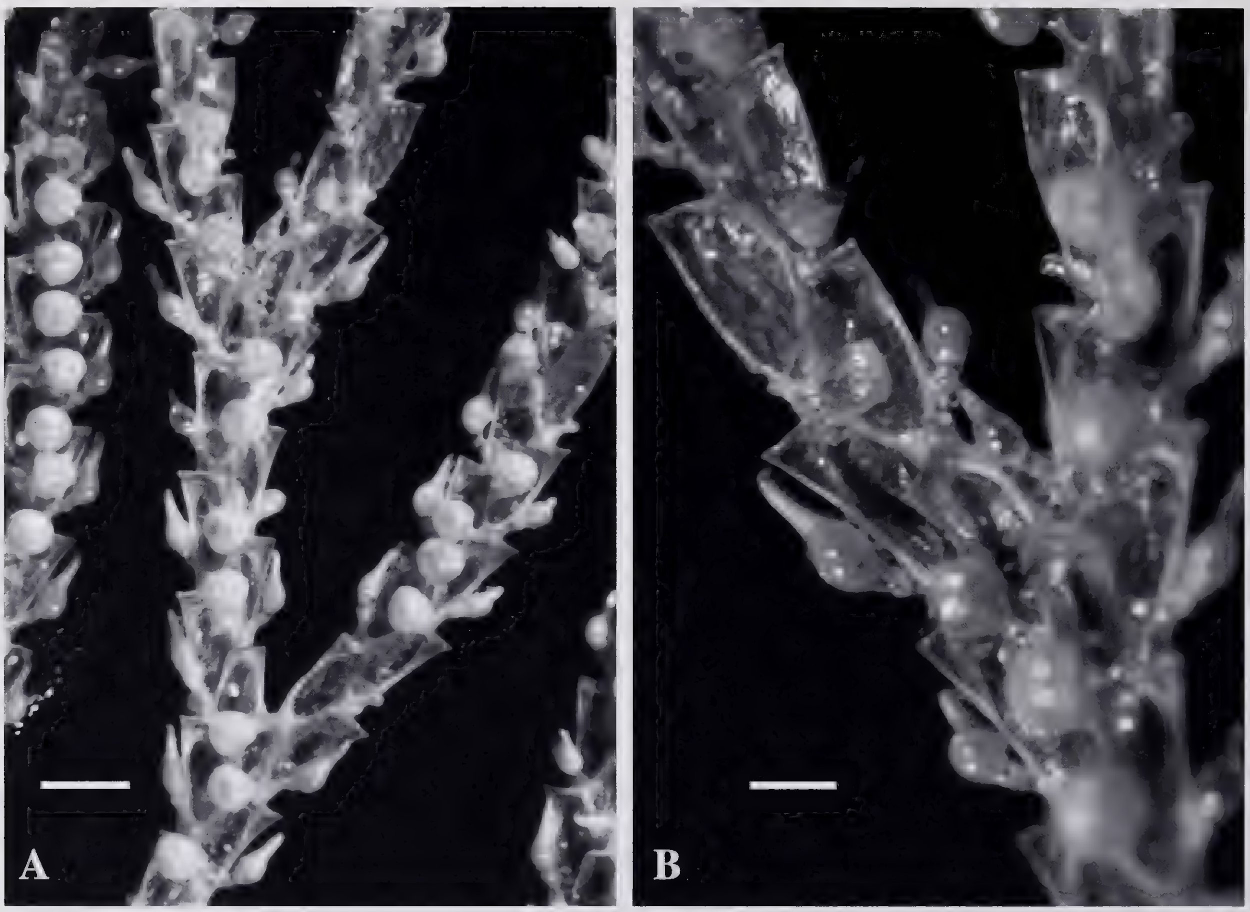

Figure 16. *Bugula solorensis* n. sp. NHM 1928.3.6.267. Solor Island specimen. Light micrograph of dry specimen on wooden slide. A. Colony branches; note feathery appearance due to position of long-beaked avicularia and shape and position of ovicells. Scale bar = 500 μm. B. Closer view of bifurcation area. Scale bar = 250 μm.

Distal rim of zooids convex to wide and scalloped, diagonally oriented to branch direction, with outer distal points short and sharp, becoming thickened and more heavily calcified with age. Frontal membrane occupies about three-quarters of the frontal wall, but other walls appear more calcified than those of any other species studied here except *B. robusta*. Avicularium round-headed and short-beaked, the peduncle attached about two-thirds of the way down the outer lateral wall of the zooid, but because of its length, the head of the avicularium has a position about halfway up the side. Ovicells higher than wide, cap- to helmet-shaped and attached to inner distal edge of zooids at an oblique angle.

Diagnosis. Zooids triangular, about 0.70–0.72 mm long by 0.29–0.37 mm wide. Distal rim of inner zooid on branch becoming wide and scalloped. Outer distal edge becoming heavily calcified in older zooids. Avicularia monomorphic, round-headed and short-beaked, on long peduncle and peduncle cushions attached about ⅔ of the way down the outer sides of zooids. Ovicells cap- to helmet-shaped.

Notes. In the strong degree of calcification of zooid walls (of older parts of colony) and more triangular zooid shape, both this species and *B. robusta* show similarities with *Halophila* species.

Specimens Examined. NHM 1979.1.8.1. *Bugula robusta* MacGillivray, Siboga Expeditie Malay Archipelago Stat: 315 [Paternoster Island, N of Sumbawa, 0–36 m. Monograph xxviii, p. 435, N. 251C. 1928.3.6.268. *Bugula robusta* MacGillivray, Siboga Expeditie Malay Archipelago Stat: 133, 0–36 m Lirung, Talaut Island, S of Mindanao. 1928.3.6.268.

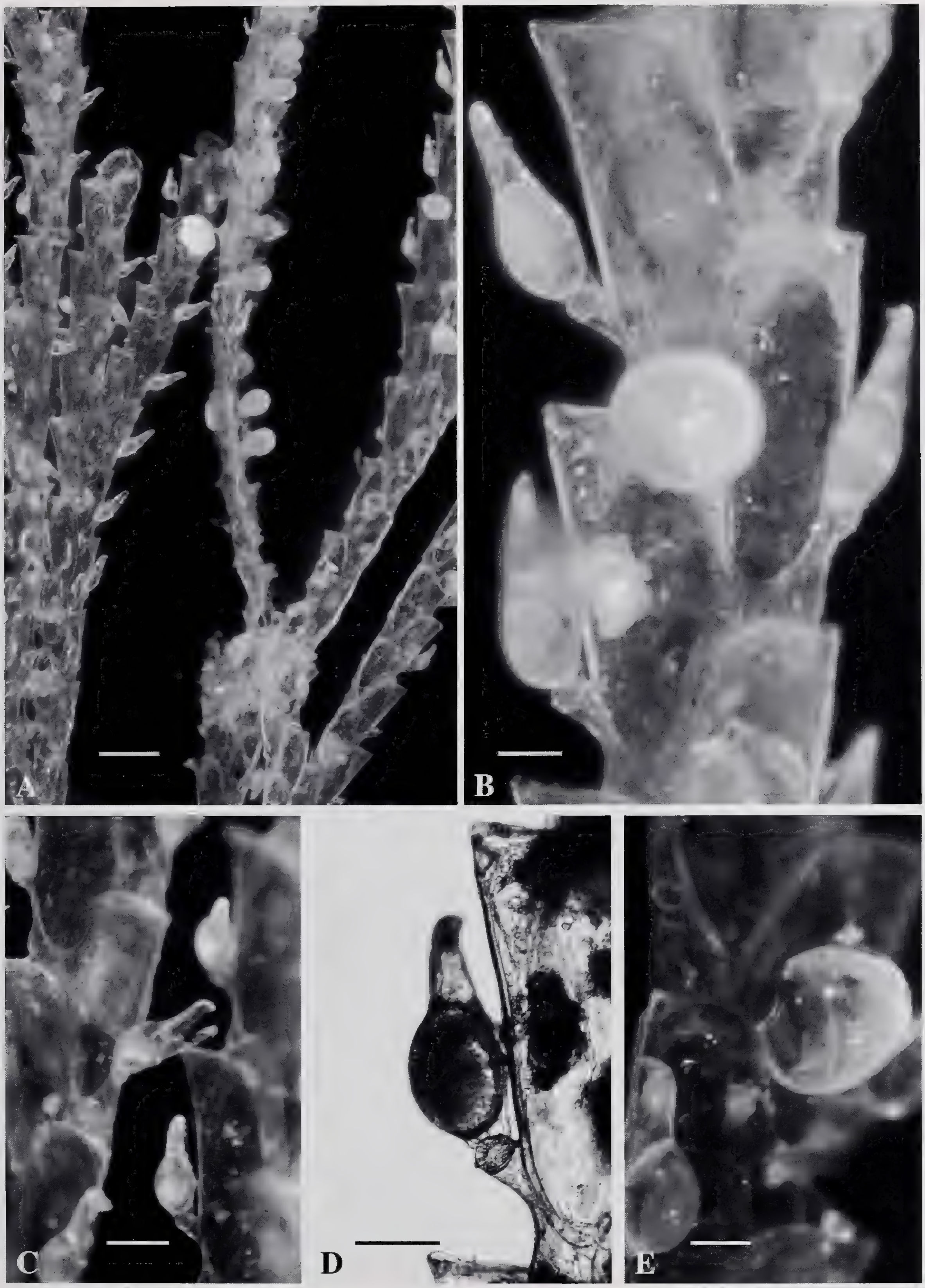

Figure 17. *Bugula solorensis* n. sp. BPBM K 1046. American Samoa. Light micrograph of wet-preserved specimen. A. Colony branches; note large diagonally oriented ovicells and feathery appearance caused by arrangement of avicularia. Scale bar = 500 μm. B. Zooids, ovicells and avicularia, note columnar peduncles of avicularia. Scale bar = 100 μm. C. Avicularia showing elongate beak, hooked at tip, and an open mandible. Scale bar = 100 μm. D. One elongated avicularium in profile. Scale bar = 100 μm. E. Close-up of cup-shaped, banded ovicell. Scale bar = 100 μm.

Figure 18. *Bugula paternostrae* new species. Holotype. NHM 1979.1.8.1. *Bugula robusta,* Paternoster Island, Indonesia. A. Branching colony with radicles at base. Scale bar = 2 mm. B. Back view of branch bifurcation. Scale bar = 500 μm. C. Frontal surface of branch showing round-headed avicularia on medium-length peduncle. Scale bar = 200 μm. D. Zooids from older part of colony showing scalloped distal rim. Scale bar = 200 μm. E. Area near growing tip showing cup- to hood-shaped ovicells. Scale bar = 200 μm.

Monograph xxviii, p. 435, N. 102A2. [dry branch on slide]. *Bugula robusta* MacGillivray, Siboga Expeditie Malay Archipelago Stat: 184, 36 m. 2000.9.18.9. Monograph xxviii, p. 435, No. 149b.

Distribution. Indonesia.

DISCUSSION

Despite their long confusion in the literature, *B. minima* and *B. robusta* are not synonymous. They appear to form a least two morphological groups of species or species complexes, all characterized by deep wine-red to red-brown pigmentation. With regard to the taxa whose questionable identities instigated this project, our results have shown that the red aviculiferous Hawaiian *Bugula* studied by Woollacott belongs in the *Bugula minima* group. With the others in that group, the specimens share a dark reddish pigmentation (very like that of *B. neritina*) when alive, a lack of spines, zooids shaped like those of *B. neritina,* an avicularium shape that is "sway-backed" with a long hooked rostrum (unlike the more common *Bugula stolonifera* type with its round body and relatively short rostrum beak), avicularia attached to proximal outer edge of zooids and usually polymorphic in size, ovicells attached at inner distal angle of zooids and oriented obliquely to branches, and relatively light calcification. The Hawaiian material shows a more pronounced avicularian dimorphism than Red Sea material.

Material from the western Atlantic that has been identified as *B. minima* since Osburn's 1914 publication on Tortugas bryozoans is not the *B. minima* of Waters. It is described here and named as *Bugula miniatella. Bugula miniatella* is similar to the Red Sea *B. crosslandi* of Hastings (1939), as well as to her and Osburn's specimens from eastern Pacific localities, in being a "minature" species, with a small mature colony size accompanied by early sexual reproduction. *Bugula crosslandi* is redescribed in accordance with the type specimen from Abu Shaar, in the Red Sea. The eastern Pacific material of Hastings and Osburn, identified by them as *B. minima* and *B. crosslandi,* probably represents a single species. However, its redescription will require further study because there may be some overlap with Caribbean species previously recorded as *B. minima,* but differing in some characters from *B. miniatella.*

In addition to those museum specimens labeled *Bugula robusta* that belong to *B. minima,* this identification has been applied to at least four taxa, all characterized by 1) dark red, purplish, or brown coloration when alive; 2) lack of spines; 3) monomorphic avicularia of the round-headed type; 4) ovicells attached at inner distal angle of zooids; and 5) avicularia attached in a position below the distal half of the outer edges of zooids. The different taxa vary from each other in ovicell shape and size, size of avicularia, position of attachment to peduncle cushion and peduncle length, degree of chitinization and calcification, relative length of frontal membrane, and shape of zooids. The true *B. robusta* of MacGillivray was described from Victoria, Australia, and appears to be a cool-water southern Australian species. Material from tropical waters identified as *B. robusta* is most likely *B. minima* or *B. robustoides* but could also belong to any of the warm-water species described above or to some red-pigmented taxon still undescribed.

The genus *Bugula* can be difficult to study, in that some of the morphometric characters that work to distinguish similar species in other genera and families do not work well in this genus. In contrast to the case in many cheilostomes, zooid length and width are not particularly good characters to use to distinguish between species because the species in the subset of the genus studied here are very similar in zooid size. Characters that have been found useful in the genus, such as coloration, colony size and growth form of colony, number of series of zooids along branches, branch bifurcation patterns, and distal spine patterns (e.g., Ryland, 1960)

are not as useful for this limited group of taxa. Although the two species with very small mature colonies could be distinguished from the others, most species were represented only by branch fragments, the complete size of their colonies unknown. All species were pigmented, but dried or wet-preserved specimens do not give an accurate idea of the color of living colonies (e.g., the gray-brown of dried *B. robusta* compared with the deep purple and orange of living colonies). All species were biserial, and most had the same bifurcation pattern (type 4). None had jointed spines, although some had sharp, pointed extensions of the distal edges of zooids.

Zooid shape; ovicell shape and orientation; occurrence of pointed, rounded, or scalloped distal ends on zooids; and degree of skeletonization are useful. Avicularia position and shape, relative proportion of head to beak, and shape and width of each part, however, seem to be the most distinctive characters at the species level. Additionally, the ratio of avicularian length to zooid width originally discussed by Ryland (1960) as a potentially useful character in distinguishing *Bugula* species appears to have value for at least some of the species studied (see Table 1).

The taxonomic and functional significance of the red coloration in the species studied here remains obscure. Only in the case of *B. neritina* have attempts been reported to localize, isolate, and/or identify the pigment. Interest in the red pigment of *B. neritina* extends back to the nineteenth century. Krukenberg (1882) refers to this pigment, "Bugulapur," as a floridine and provides spectra under different solvent regimes. Fürth (1903) supplies a list of its basic chemical properties. Subsequent studies by Villela (1948a,b) report that the red pigment in *B. neritina* is adenochrome-like in its properties and provides a protocol for its isolation along with a more lengthy characterization of its chemistry. The chemical properties of this pigment are discussed apparently most recently by Christophersen (1985) and Christophersen and Anthoni (1986). These authors note that preliminary studies indicate it is a sulfur-containing compound. Villela (1948a,b) observed that the pigment is most evident in distal zooids on branches of colonies and also in association with brown bodies. Woollacott and Zimmer (1971, 1975) provided ultrastructural and light microscopic evidence that the larva the pigment is localized in brick-like stacks of "pigmented cells" that occur in a subepidermal location between adjacent coronal cells and in association with the apical disk. On metamorphosis, some of these pigment-bearing cells form the somatic and splanchnic peritoneum, whereas others are found with the funicular tissue. There is no indication of their functional role in either larval or adult stages.

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Anatomical Basis of Differences in Locomotor Behavior in *Anolis* Lizards: A Comparison Between Two Ecomorphs

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ANATOMICAL BASIS OF DIFFERENCES IN LOCOMOTOR BEHAVIOR IN *ANOLIS* LIZARDS: A COMPARISON BETWEEN TWO ECOMORPHS

ANTHONY HERREL,[1] BIEKE VANHOOYDONCK,[2] JOANNE PORCK,[3] AND DUNCAN J. IRSCHICK[4]

ABSTRACT. *Anolis* lizards have become model organisms for the study of adaptive radiation, as on each of the larger islands in the Caribbean, animals with similar morphologies have independently radiated into similar ecological niches. Central in the study of these animals have been the investigations correlating differences in limb dimensions to substrate characteristics and locomotor performance. However, little is known about differences in the musculoskeletal system that could underlie the observed differences in performance or locomotor style (i.e., gait characteristics). Here, we provide data on the morphology of the appendicular skeleton and musculature in two species of *Anolis* that differ greatly in habitat use and locomotor performance: *A. sagrei* and *A. valencienni.* The first and principal objective was to provide a detailed description of the appendicular morphology that could serve as a basis for further study. Our second objective was to test for quantitative differences in muscle mass and muscle mass distribution between the two species. Finally, we explore how the observed differences in the musculoskeletal system might be correlated with locomotor performance and locomotor style by analyzing data on the spatiotemporal gait characteristics in these two species while they were moving on substrates of different diameters. Our data show distinct differences in the morphology, muscle mass, and muscle mass distribution and illustrate how these may result in greater step and stride lengths in *A. sagrei,* allowing it to achieve higher sprint speeds. *Anolis valencienni* has less robust muscles that might constrain step and stride length, which in turn could provide it with greater stability on narrow substrates.

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INTRODUCTION

Anolis lizards have become model organisms for the study of adaptive radiation, in that on each of the larger islands in the Caribbean, species with similar morphologies have independently adapted to similar ecological niches (Losos, 1990a,b; Losos et al., 1998; Schluter, 2000; Williams, 1983). Central to the study of these animals have been the investigations correlating differences in limb dimensions to substrate characteristics and locomotor performance (Irschick and Losos, 1998, 1999; Losos and Irschick, 1996; Losos and Sinervo, 1989; Losos et al., 1997; Vanhooydonck et al., 2006a,b). These and other studies have demonstrated how the interaction of limb morphology with substrate characteristics is crucial in setting limits on locomotor performance (Irschick and Losos, 1998; Losos and Sinervo, 1989; Vanhooydonck et al., 2005). For example, lizards with long limbs can achieve higher velocities on broad substrates (Irschick and Losos, 1998; Losos and Sinervo, 1989; Sinervo and Losos, 1991) and have greater acceleration capacities on both broad and narrow substrates (Vanhooydonck et al., 2006b) but could face a decrease in stability on narrow substrates, causing them to stumble and fall more often (Losos and Sinervo, 1989). Moreover, the trade-off between sprint speed and surefootedness has been suggested to be an important component of habitat choice in arboreal lizards (Irschick and Losos, 1999).

Despite the importance of limb mor-

phology in shaping locomotor performance and habitat use, little is known about differences in the musculoskeletal system that are responsible for the observed differences in performance and locomotor style among species and ecomorphs (but see Vanhooydonck et al., 2006a). Yet differences in muscle mass, muscle architecture, and muscle position could be crucially important in allowing animals to achieve greater performance in specific ecological settings. For example, Zaaf and co-workers (1999, 2001) demonstrated how differences in the mass and position of the fore and hindlimb muscles might provide a performance advantage to climbing geckos moving on vertical substrates. Consequently, one would expect that *Anolis* lizards that spend more time in arboreal habitats would also show specializations in the forelimb muscles, allowing them to generate greater forces to move against gravity, as has been demonstrated for geckos (Autumn et al., 2006). Specifically, we predict that arboreal species will allocate more of the total forelimb muscle mass to humerus retractors, which are thought to be important in generating pulling forces with the forelimbs (Zaaf et al., 1999). Conversely, fast terrestrial or semi-arboreal species can be expected to have more robust hindlimb extensors that allow them to achieve greater velocities and accelerations (see also Vanhooydonck et al., 2006a). Given the trade-off previously noted between sprint speed and surefootedness (Losos and Sinervo, 1989), we predict that animals adapted to moving on narrow substrates will have shorter step and stride lengths and will move their limbs at lower frequency, which would allow them to maintain stability on narrow substrates (Spezzano and Jayne, 2004).

Here, we explore differences in the morphology of the appendicular system in two species of *Anolis* lizards, *A. sagrei* and *A. valencienni,* that differ markedly in overall body and limb shape (Losos, 1990a,b; Fig. 1), maximal locomotor speed (Losos, 1990b), acceleration capacity (Vanhooydonck et al., 2006b), and habitat use (Losos, 1990b) but are relatively closely related to each other (both belong to the Norops clade of *Anolis*; see Nicholson et al., 2005). Whereas *A. sagrei* is a typical trunk-ground anole that often occurs on the ground and on broad substrates, *A. valencienni* is a twig anole that spends most of its time moving on narrow substrates. The first and principal goal of this paper is to give a complete and detailed description of the anatomy of the fore- and hindlimb muscles. Our second objective is to test for quantitative differences in muscle mass and muscle mass distribution between species. Our final objective is to explore whether the observed differences in the morphology of the appendicular skeleton can be linked to differences in locomotor style by analyzing the spatiotemporal gait characteristics of both species moving on two substrates of different diameters.

MATERIALS AND METHODS

Animals

Between November 2001 and February 2002, we captured 15 male *A. sagrei* Cocteau (snout–vent length [SVL] = 59.22 ± 0.36 mm; mean ±77 SD) and 10 male *A. valencienni* Dumeril and Bibron (SVL = 67.9 ± 1.4 mm) by hand or noose. The *A. sagrei* individuals were captured on the mainland United States (Miami, Florida). *Anolis valencienni* individuals were caught around the Discovery Bay Marine Laboratory in Jamaica. All the animals were transported back to the laboratory at Tulane University (New Orleans, Louisiana). Upon arrival in the lab, the lizards were housed in pairs in 40-liter terraria lined with leaf litter and containing a dowel. Terraria were placed in a temperature-controlled room (29 ± 2° C) with a 12:12 hour light:dark photoperiod. We fed the animals live crickets dusted with calcium and vitamin supplements three times a week; lizards were sprayed with water daily.

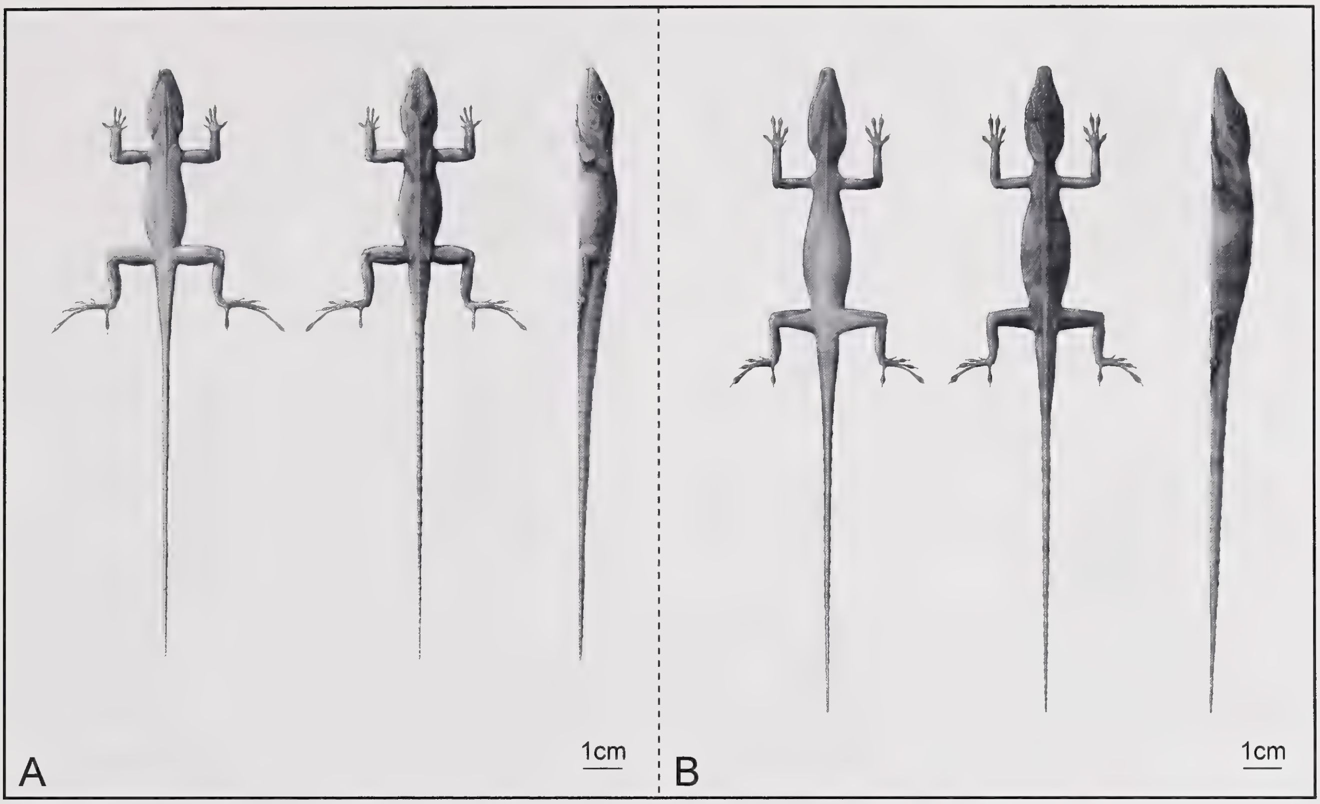

Figure 1. Drawing of (A) *Anolis sagrei* and (B) *Anolis valencienni* in ventral, dorsal, and lateral view illustrating differences in overall body and limb proportions. Note how *A. sagrei* has relatively longer distal hindlimb segments and a longer tail but shorter body and head compared with *A. valencienni*. Differences in distal hindlimb segments (tibia, metatarsus, longest toe) and the length of the longest toe of the forelimb are significantly different between species. *Scale bar:* 1 cm.

Morphology

A different set of preserved specimens of both *A. sagrei* (N = 6; SVL = 55.79 ± 1.88 mm) and *A. valencienni* (N = 6; SVL = 66.26 ± 2.52 mm) were dissected, and all muscles were taken out and sorted by function into the following groups: femur protractors, femur retractors, femur adductors, femur abductors, knee flexors, knee extensors, ankle flexors, ankle extensors, a miscellaneous group (containing the lower hindlimb pronators and rotators), humerus protractors, humerus retractors, humerus adductors, humerus abductors, elbow flexors, elbow extensors, wrist flexors, wrist extensors, and a group containing the lower forelimb pronators and rotators. The assignment of muscles to functional groups is based on their position and on manipulation of dissected specimens. Note, however, that the assignment of muscles to functional groups needs to be confirmed by in vivo studies of muscle function and that our assignment need not correspond to descriptions for other species because of variation in muscle attachment sites. Muscles were stored by group in vials with 70% ethanol, blotted dry, and weighed per functional group on a Mettler MT5 electronic balance (±0.1 mg). Note that, given the small size of these animals, muscle groups often weigh less than 10 mg and thus require the use of a precision balance.

Running Trials

We induced lizards to run up a plastic dowel covered with metal wire mesh (mesh width 1 mm) by clapping our hands or tapping the lizards slightly on the base of their tail. All lizards were tested on both a broad and a narrow dowel (diameters of 8 and 1 cm, respectively). Both dowels were 2 m long and placed against the wall

at an angle of 45° (see Vanhooydonck et al., 2006a,b). Lizards were filmed in lateral view over a distance of 1 m with a high-speed video camera (Redlake Motionscope PCI camera) set at 250 frames/s. We performed between five and 10 trials per individual on each dowel. Trials were conducted on several nonconsecutive days, with trials on the broad and narrow dowel alternated among days. Before experimentation and between trials, the lizards were placed in an incubator set at 32° C for at least 1 hour to allow the lizards to attain body temperatures similar to their preferred field body temperatures (see also Toro et al., 2003).

After filming, we digitized the tip of the snout at 250 frames/s with the use of Peak Performance MOTUS software from the moment the lizard started running until it ran out of view. Of the same sequences, we obtained footfall patterns by recording the frames at which the right hindfoot touched the substrate (i.e., foot contact) and the frames at which the right hindfoot lost contact with the substrate (i.e., foot release). On the basis of displacement of the snout tip and the footfall patterns, we subsequently calculated stride length (the distance traveled by the center of mass of an animal in a complete cycle of limb movements), stride frequency (the number of cycles per second), step length (the distance the body moves forward during the stance of a particular leg), and mean speed per stride for successive strides during steady state locomotion.

Statistical Analyses

Morphometric and muscle mass data were log transformed before analysis to conform to assumptions of homoscedascity and normality required for parametric analyses. Analyses of variance were used to test for differences between species in limb dimensions, in total hindlimb and front limb muscle mass, and in the mass of the different functional groups.

Because we were mainly interested in steady state locomotion, we only used data on gait characteristics of the third, fourth, and fifth stride in a sequence (i.e., after the initial acceleration phase, and when locomotion was largely steady, as indicated by the absence of fluctuations in the velocity profile; see Vanhooydonck et al., 2006b). Before statistical analyses, stride length, step length, and stride frequency were expressed in units of hindlimb length, because hindlimb length differs significantly between *A. valencienni* and *A. sagrei* and because gait characteristics are determined on the basis of hindlimb footfall patterns. Total hindlimb length was determined on the basis of the sum of the individual limb segments. All gait characteristics were log transformed before analyses. A two-way multivariate analysis of covariance, with stride length, stride frequency, and step length as dependent variables; stride speed as covariate; and species and dowel as factors, was performed. Nonsignificant interaction effects were removed from the final model. All analyses were performed using SPSS V.13.0.

RESULTS

Anatomy

Here, we first provide a brief qualitative description of the differences in the pectoral and pelvic girdle of the two species. Next, we give a brief description of the ligaments of the pelvic girdle and a description of the fore- and hindlimb muscles. The descriptions are principally based on *A. sagrei* except where important differences between species were observed. We follow the terminology adopted by Zaaf et al. (1999), Moro and Abdala (2004), and Abdala and Moro (2006) in our descriptions of the muscles. In addition, we used papers by Landsmeer (1984, 1990) and Russell (1988) as a basis for our descriptions of the limb muscles.

Pelvic and Pectoral Girdle (Figs. 2, 3). Both the pelvic and pectoral girdle show differences in shape between the two species. The most striking difference is the

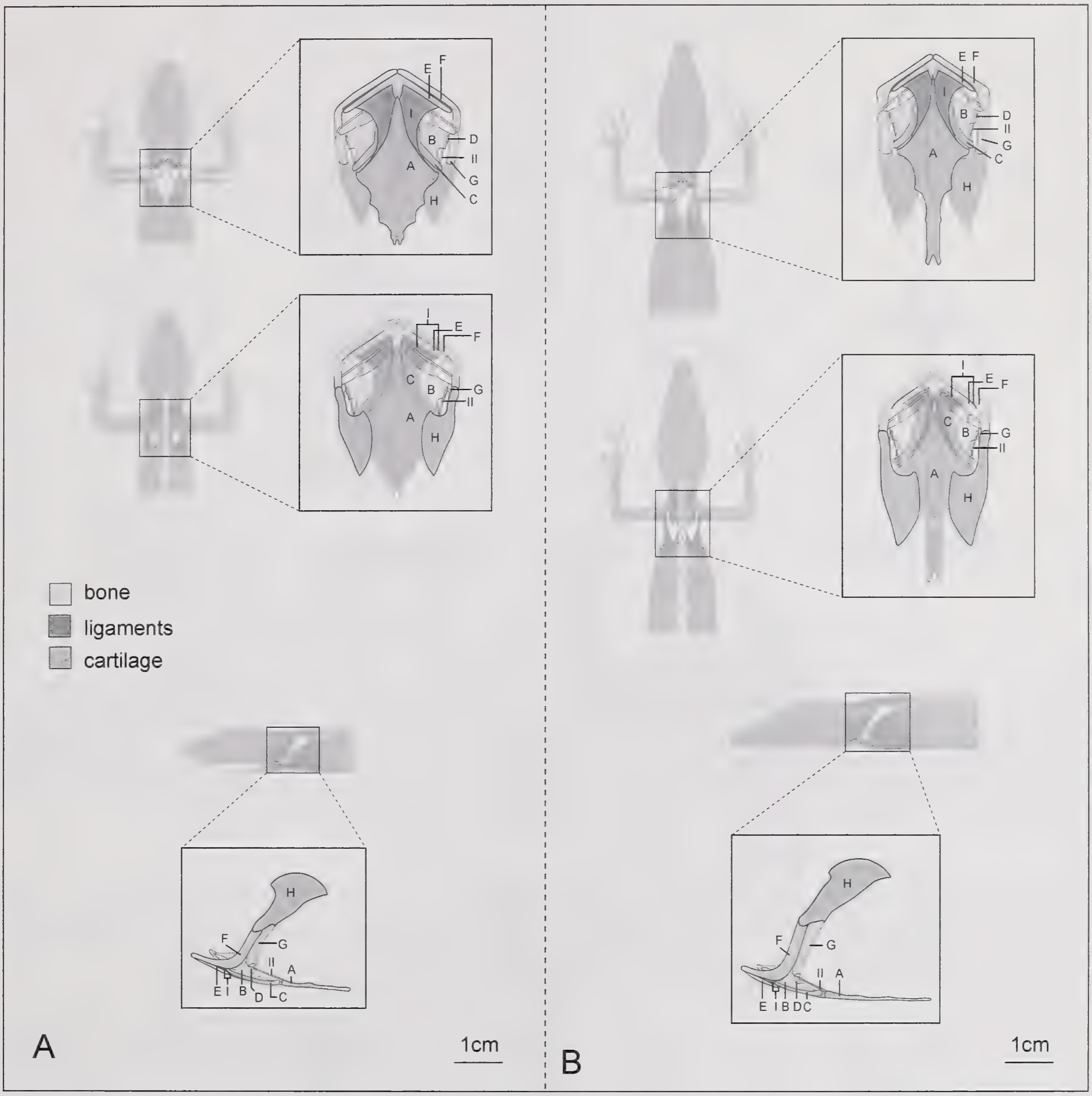

Figure 2. Schematic drawing illustrating the pectoral girdle in (A) *A. sagrei* and (B) *A. valencienni.* Shown are a ventral, a dorsal, and a lateral view (from top to bottom) for each species. The position of the girdle in the body, as well as a blow-up detailing the girdle itself, is shown for each view. Note the more elongated and narrower pectoral girdle with elongated sternum in *A. valencienni.* I, Ligamentum sternoclaviculare; II, Ligamentum sternocoracoideum; A, sternum; B, coracoid; C, epicoracoid; D, glenoid fossa; E, interclavicula; F, clavicula; G, scapula; H, suprascapula.

more elongated and narrower appearance of the girdles in *A. valencienni* compared with *A. sagrei* (see also Beuttell and Losos, 1999). The pectoral girdle in *A. valencienni* is further characterized by an elongated sternum, an expanded suprascapula and a more perpendicularly positioned scapula and clavicula. The pelvic girdle in *A. sagrei* is generally broader and has an ilium that is directed more dorsally compared with that of *A. valencienni* (Fig. 3). The anterior part of the ischium is, however, more elongated in *A. valencienni*.

Ligaments (Figs. 2, 3). The following description of the ligaments applies to both species.

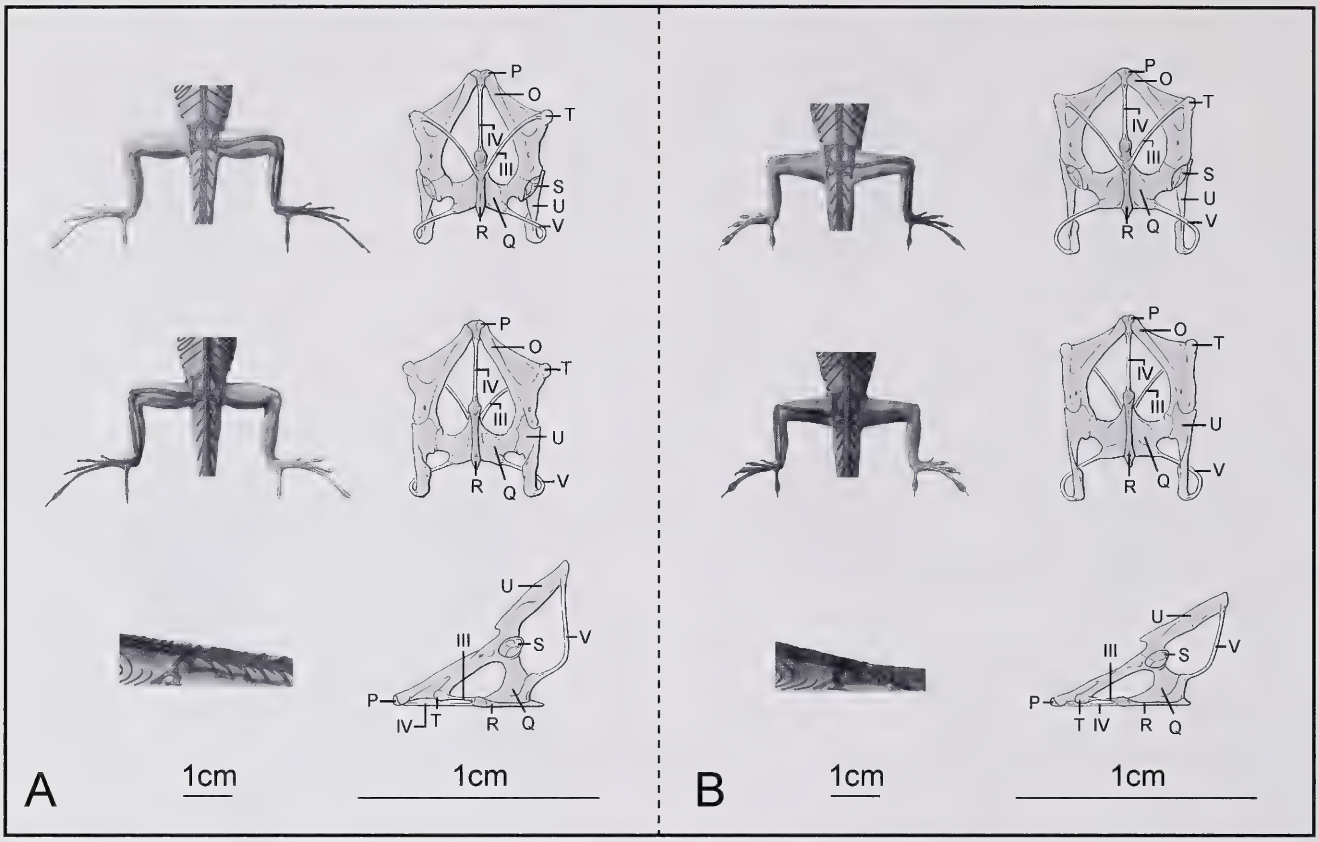

Figure 3. Schematic drawing illustrating the pelvic girdle in (A) *A. sagrei* and (B) *A. valencienni.* Shown are a ventral, a dorsal and, a lateral view (from top to bottom) for each species. The position of the girdle in the body, as well as a blow up detailing the girdle itself, is shown for each view. Note the more elongate and narrower pelvic girdle with relatively shorter ilium in *A. valencienni.* III, ligamentum puboischiadum pars lateralis; IV, ligamentum puboischiadum pars medialis; V, ligamentum ilioischiadum; O, pubis; P, epipubis; Q, ischium; R, hypoischium; S, acetabulum; T, pectineal tubercle; U, ilium.

Ligamentum sternoclaviculare (I): runs from the lateroventral aspect of the sternum to the interclaviculum and claviculum, where it attaches broadly along the posterior ventral aspect.

Ligamentum sternocoracoideum (II): runs from its origin on the dorsal side at the lateralmost aspect of the sternum to the lateral dorsal side of the coracoid near its articulation with the scapula.

Ligamentum puboischiadum pars lateralis (III): originates at the ventral aspect of the ischium and runs to the ventrolateral side of the lateralmost protruberance of the pubis (pectineal tubercle).

Ligamentum puboischiadum pars medialis (IV): originates at the cranial end of the pubis (epipubis), runs directly posteriad, and inserts on the ventrocranial side of the ischium.

Ligamentum ilioischiadum (V): runs from the caudodorsal and lateral side of

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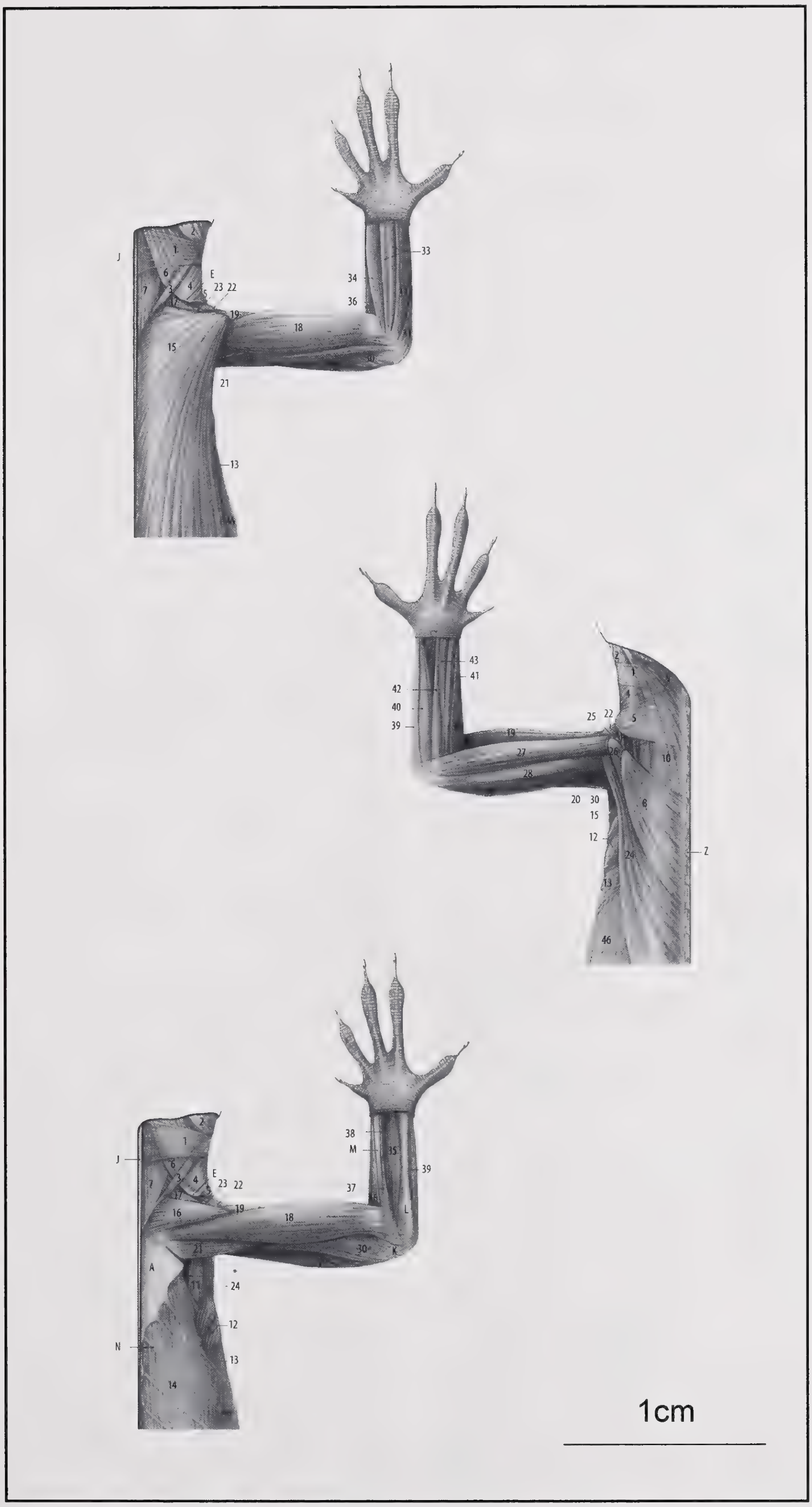
Figure 4. Anatomical drawings illustrating the forelimb musculature in *A. sagrei.* Shown are a superficial ventral view, a superficial dorsal view, and a deep ventral view (from top to bottom). 1. M. constrictor colli. 2. M. pterygoideus. 3. M. episternocleidomastoideus pars anterior. 4. M. episternocleidomastoideus pars posterior. 5. M. levator scapula. 6. M. omohyoideus. 7. M. sternohyoideus. 8. M. trapezius. 9. M. depressor mandibulae. 10. M. cervicomandibularis. 11. M. transverso spinalis complex. 12. M. serratus. 13. Mm. levatores costae. 14. M. intercostalis. 15. M. pectoralis pars superficialis. 16. M. pectoralis pars profundus. 17. M. coracohumeralis. 18. M. biceps brachii pars ventralis. 19. M. biceps brachii pars dorsalis. 20. M. coracobrachialis longus. 21. M. coracobrachialis brevis. 22. M. clavodeltoideus pars superficialis. 23. M. clavodeltoideus pars profundus. 24. M. latissimus dorsi. 25. M. scapulodeltoideus pars anterior. 26. M. scapuladeltoideus pars posterior. 27. M. triceps pars humeralis anterior. 28. M. triceps pars humeralis posterior. 29. M. triceps pars scapulohumeralis. 30. M. triceps pars scapularis. 31. M.



epitrocheloanconus. 32. M. flexor carpi ulnaris. 33. M. flexor digitorum longus pars ulnaris. 34. M. flexor digitorum longus pars radialis. 35. M. flexor digitorum longus pars profundus. 36. M. flexor carpi radialis. 37. M. pronator teres. 38. M. pronatoraccesorius. 39. M. extensor carpi ulnaris. 40. M. abductor pollicis longus. 41. M. extensor carpi radialis. 42. M. extensor digitorum longus pars superficialis. 43. M. extensor digitorum longus pars profundus. 46. M. obliquus abdominis. A, sternum; E, interclavicula; J, ceratobranchiale 2; K, humerus; L, ulna; M, radius; N, costa sternalis; Z, processus spinosus vertebra. * Deeper structures, not labeled.

the ischium to the posterolateral side of the ilium.

Forelimb Musculature (Figs. 4, 5). Musculus pectoralis (15, 16): consists of two distinct parts:

1) M. pectoralis pars superficialis (15): This is the largest part of the M. pectoralis and originates at the lateral edge of the sternum. In *A. valencienni,* the M. pectoralis pars superficialis originates at the anterior aspect of the last sternal rib, as well as the anterior aspects of the abdominal ribs. In both species, the muscle inserts by means of a short, robust tendon at the anterior proximal aspect of the humerus on the humeral tubercle. Proposed function: humeral retraction.

2) M. pectoralis pars profundus (16): The pars profundus is partly hidden under the pars superficialis in superficial view. The fibers originate at the ventromedial aspect of the sternum and the interclavicula. The fibers converge near their insertion and insert proximal to the humeral tubercle. Proposed function: humeral adduction.

M. coracohumeralis anterior (17): originates at the cranioventral surface of the coracoid and inserts at the medial side of the humeral tubercle. Proposed function: humeral protraction.

M. biceps (18, 19): consists of two parts. The first part (19) originates by means of a long narrow tendon on the medioventral aspect of the coracoid. The second part (18) originates fleshy along the entire cranioventral side of the humerus, anterior to the humeral tubercle. The fibers of both parts merge and insert partly fleshy and partly by means of a short aponeurosis at the proximal aspect of both the ulna and radius. Proposed function: elbow flexion.

M. coracobrachialis longus (20): originates by means of a short tendon at the posterior aspect of the coracoid and inserts along the ventral aspect of the humerus, near the elbow joint. Proposed function: humeral adduction.

M. coracobrachialis brevis (21): originates along the posterior half of the ventral aspect of the coracoid and inserts ventrally along the proximal 30% of the humerus. In *A. valencienni* the M. coracobrachialis inserts along the proximal 60% of the humerus. Proposed function: humeral adduction. Note that this muscle functions to retract the humerus in *Varanus* (Jenkins and Goslow, 1983). In the *Anolis* species studied here, this muscle could also induce humeral retraction following a full protraction of the arm. This needs, however, to be corroborated by in vivo studies.

M. clavodeltoideus superficialis (22): originates at the ventral aspect of the interclavicula and the posteroventral aspect of the clavicula. The fibers run obliquely posterolaterad and insert on the cranial aspect of the humerus proximal to the deltopectoral tubercle. Proposed function: humeral protraction.

M. clavodeltoideus profundus (23): originates at the ventral side of the interclavicula, runs anteriad, curves around the interclavicula, runs posteriad in between the clavicula and scapula, and inserts proximally on the dorsocranial side of the humerus. Proposed function: humeral abduction.

M. latissimus dorsi (24): originates at the mid-dorsal cervical connective tissue raphe and the neural spines of the thoracic vertebrae. The fibers run anteroventrad and insert by means of a short and thick tendon along the proximal dorsocaudal aspect of the humerus. Proposed function: humeral retraction.

M. scapulodeltoideus anterior (25): originates at the junction of the scapula and suprascapula as well as on the medioventral side of the scapula. The fibers insert by means of a short but clear tendon at the dorsal side of the humerus, anterior to the insertion of the M. scapulodeltoideus posterior. Proposed function: humeral abduction.

M. scapulodeltoideus posterior (26): originates at the external side of the suprascapula and inserts proximally on the dorsal side of the humerus at the level of

the humeral tubercle. Proposed function: humeral abduction.

M. triceps brachii (27–30): consists of three bundles: The medial bundle originates by means of a thin tendon at the lateral side of the base of the scapula (pars scapularis, 30). The caudal bundle originates by means of a long, thin tendon from the scapulocoracoid ligament. Some fibers coming from the caudal side of the humerus join the bundle (pars scapulohumeralis, 29). The cranial bundle originates at the cranial aspect of the humerus (pars humeralis anterior, 27). A second slip originating at the caudal aspect of the humerus (pars humeralis posterior, 28) joins this bundle about midway. Both slips are separated from one another by the insertion of the M. latissmus dorsi. All parts merge near the elbow and insert onto a common thick tendon that curves around the elbow and inserts at the proximal side of the ulna. Proposed function: elbow extension.

M. epitrocleoanconus (31): originates by means of a short tendon on the ventral side of the distal aspect of the humerus and runs alongside the ulna to insert along the first quarter of the ventral side of the ulna. Proposed function: radio-ulnar rotation.

M. flexor carpi ulnaris (32): originates by means of a short tendon at the ventral side of the distalmost aspect of the humerus. The muscle consists of two parts: a lateral part that inserts onto the ulnare by means of a short tendon and a medial part that inserts along the distal aspect of the ulna. Proposed function: the lateral part, wrist flexor; the medial part, elbow flexor.

M. flexor digitorum longus (33–35): consists of three parts. The pars radialis (34) lies at the radial side, originates at the distal tubercle of the humerus, and runs between the radius and ulna. It inserts by means of a tendon which splits to insert on the distal phalanges of toes three and four. The M. flexor digitorum longus pars ulnaris (33) is composed of two bellies that both originate at the distal aspect of the humerus by means of a short tendon. The two bellies unite about halfway down and converge into a thick tendon that ultimately splits and inserts on the distal phalanges of toes 2, 3, and 4. A small group of fibers coming from the ulna joins this muscle along its course. The M. flexor digitorum longus pars profundus (35) is the deepest of the three parts. It originates on the ventral side of the ulna and inserts by means of a clear tendon that trifurcates at the level of the hand. The first tendon inserts on the distal phalanx of toe 1, the second on the distal phalanx of toe 2, and the third on the distal phalanx of toe 3. Proposed function: wrist and digit flexion.

M. flexor carpi radialis (36): originates at the dorsolateral surface of the distal tubercle of the humerus. The muscle runs alongside the radius and inserts on the distal half thereof. Proposed function: elbow flexion.

M. pronator teres (37): originates by means of a short tendon at the ventral side of the distal aspect of the humerus and inserts fleshy on the proximal fourth of the radius. In *A. valencienni,* this muscle inserts on the distal fourth of the radius. Proposed function: radio-ulnar rotation.

M. pronator accesorius (38): originates along the proximal two thirds of the ulna and inserts on the middle third of the radius. Proposed function: radio-ulnar rotation.

M. extensor carpi radialis (39): originates by means of a short tendon at the distal aspect of the humerus. The muscle runs alongside the radius and inserts along its entire dorsal side. Proposed function: elbow extension.

M. abductor longis pollici (40): originates broadly along the distal third of the ulna. The muscle narrows toward its insertion and inserts tendinously at the distal, dorsal aspect of the first metacarpal of digit 1. Proposed function: wrist extension.

M. extensor carpi ulnaris (41): originates at the distal head of the humerus by means of a short tendon. The muscle runs alongside the ulna and the fibers insert partly

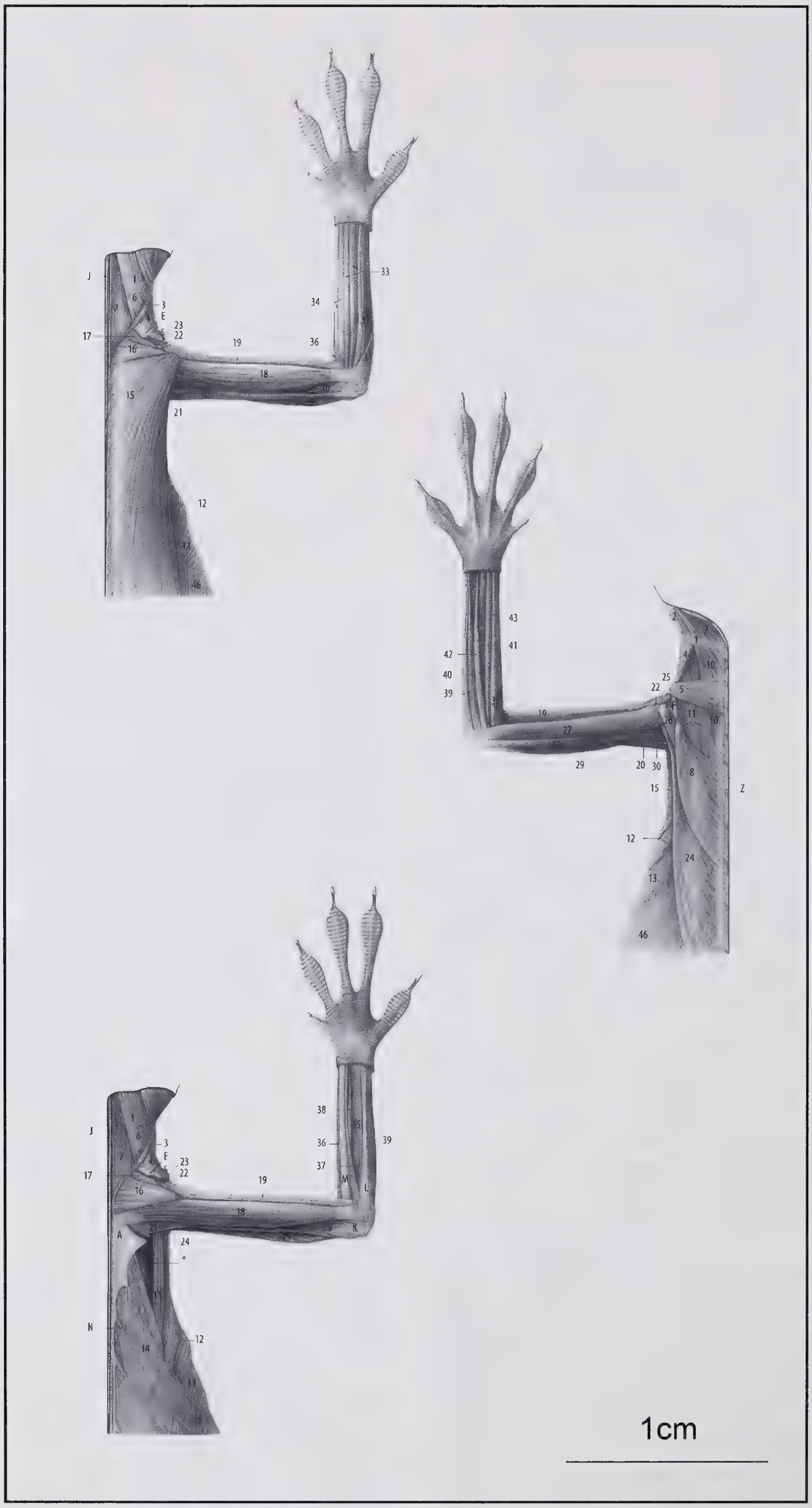


Figure 5. Anatomical drawings illustrating the forelimb musculature in *A. valencienni.* Shown are a superficial ventral view, a superficial dorsal view, and a deep ventral view (from top to bottom). Note the more robust musculature in *A. sagrei* depicted in Figure 4. 1. M. constrictor colli. 2. M. pterygoideus. 3. M. episternocleidomastoideus pars anterior. 4. M. episternocleidomastoideus pars posterior. 5. M. levator scapula. 6. M. omohyoideus. 7. M. sternohyoideus. 8. M. trapezius. 9. M. depressor mandibulae. 10. M. cervicomandibularis. 11. M. transverso spinalis complex. 12. M. serratus. 13. Mm. levatores costae. 14. M. intercostalis. 15. M. pectoralis pars superficialis. 16. M. pectoralis pars profundus. 17. M. coracohumeralis. 18. M. biceps brachii pars ventralis. 19. M. biceps brachii pars dorsalis. 20. M. coracobrachialis longus. 21. M. coracobrachialis brevis. 22. M. cla-

fleshy, partly through a joined tendon with the M. flexor carpi ulnaris at the distal part of the ulna. A tendon coming from this muscle also runs to the lateral aspect of the fifth metacarpal. Proposed function: elbow and wrist extension.

M. extensor digitorum longus pars superficialis (42): originates by means of a short tendon at the distal aspect of the humerus together with the M. extensor carpi radialis. Both muscles run adjacent to one another for the first third of their length. The M. extensor digitorum longus pars superficialis inserts at the dorsal aspect of the fifth metacarpal. Proposed function: wrist extension.

M. extensor digitorum longus pars profundus (43): runs alongside the M. extensor carpi radialis and inserts at the dorsal side of metacarpals 2 and 3. Proposed function: wrist extension.

M. scapulohumeralis superficialis (not drawn): originates at the cranial aspect of the ventral part of the suprascapula and the dorsal part of the scapula. The muscle inserts proximally on the caudal aspect of the humerus. Proposed function: humeral abduction.

M. scapulohumeralis profundus (not drawn): originates at the caudal aspect of the scapula and inserts at the proximal dorsal side of the humerus. Proposed function: humeral abduction.

M. coracohumeralis posterior (not drawn): originates at the ventral surface of the coracoid, posterior to the coracoidal fenestra, and inserts proximally at the ventral aspect of the humerus, caudal to the humeral tubercle. Proposed function: humeral adduction.

M. supracoracoideus (not drawn): originates at the anterior dorsal side of the coracoid and inserts at the proximodorsal aspect of the humerus. Proposed function: humeral retraction and shoulder stabilization (see also Jenkins and Goslow, 1983).

Mm. extensores digitorum breves (not drawn): is a set of short muscles that originate at the dorsal side of the ulnare and insert on metacarpals 2 to 4. The last one runs to the base of the first phalanx of the fifth toe. Proposed function: wrist extension.

M. pronator profundus (not drawn): originates on the distal two thirds of the ulna and inserts on the distal two thirds of the radius. Proposed function: radio-ulnar rotation.

Hindlimb Musculature (Figs. 6–9).

M. puboischiotibilais (50): is the superficialmost muscle in ventral view. It originates at the ventral side of the lateral puboischiadic ligament (the cranialmost fibers), the ventrolateral side of the ischium, and the ilioischiadic ligament. The fibers converge toward their insertion on the cranial, ventromedial side of the tibia. The insertion is partly fleshy, partly by a shared tendon with the M. flexor tibialis internus. Proposed function: knee flexion and femoral adduction.

M. pubofibularis (51): originates on the aponeurosis communis. The muscle crosses the M. adductor femoris and inserts together with the M. ilioischiofibularis by means of a short tendon at the cranial aspect of the fibula. Proposed function: femoral adduction.

M. tensor aponeurosis communis (52): is a short and small muscle that originates at the aponeurosis communis and inserts at the cranioventral side of the femoral

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vodeltoideus pars superficialis. 23. M. clavodeltoideus pars profundus. 24. M. latissimus dorsi. 25. M. scapulodeltoideus pars anterior. 26. M. scapuladeltoideus pars posterior. 27. M. triceps pars humeralis anterior. 28. M. triceps pars humeralis posterior. 29. M. triceps pars scapulohumeralis. 30. M. triceps pars scapularis. 31. M. epitrocheloanconus. 32. M. flexor carpi ulnaris. 33. M. flexor digitorum longus pars ulnaris. 34. M. flexor digitorum longus pars radialis. 35. M. flexor digitorum longus pars profundus. 36. M. flexor carpi radialis. 37. M. pronator teres. 38. M. pronator accesorius. 39. M. extensor carpi ulnaris. 40. M. abductor pollicis longus. 41. M. extensor carpi radialis. 42. M. extensor digitorum longus pars superficialis. 43. M. extensor digitorum longus pars profundus. 46. M. obliquus abdominis. A, sternum; E, interclavicula; J, ceratobranchiale 2; K, humerus; L, ulna; M, radius; N, costa sternalis; Z, processus spinosus vertebra. * Deeper structures, not labeled.

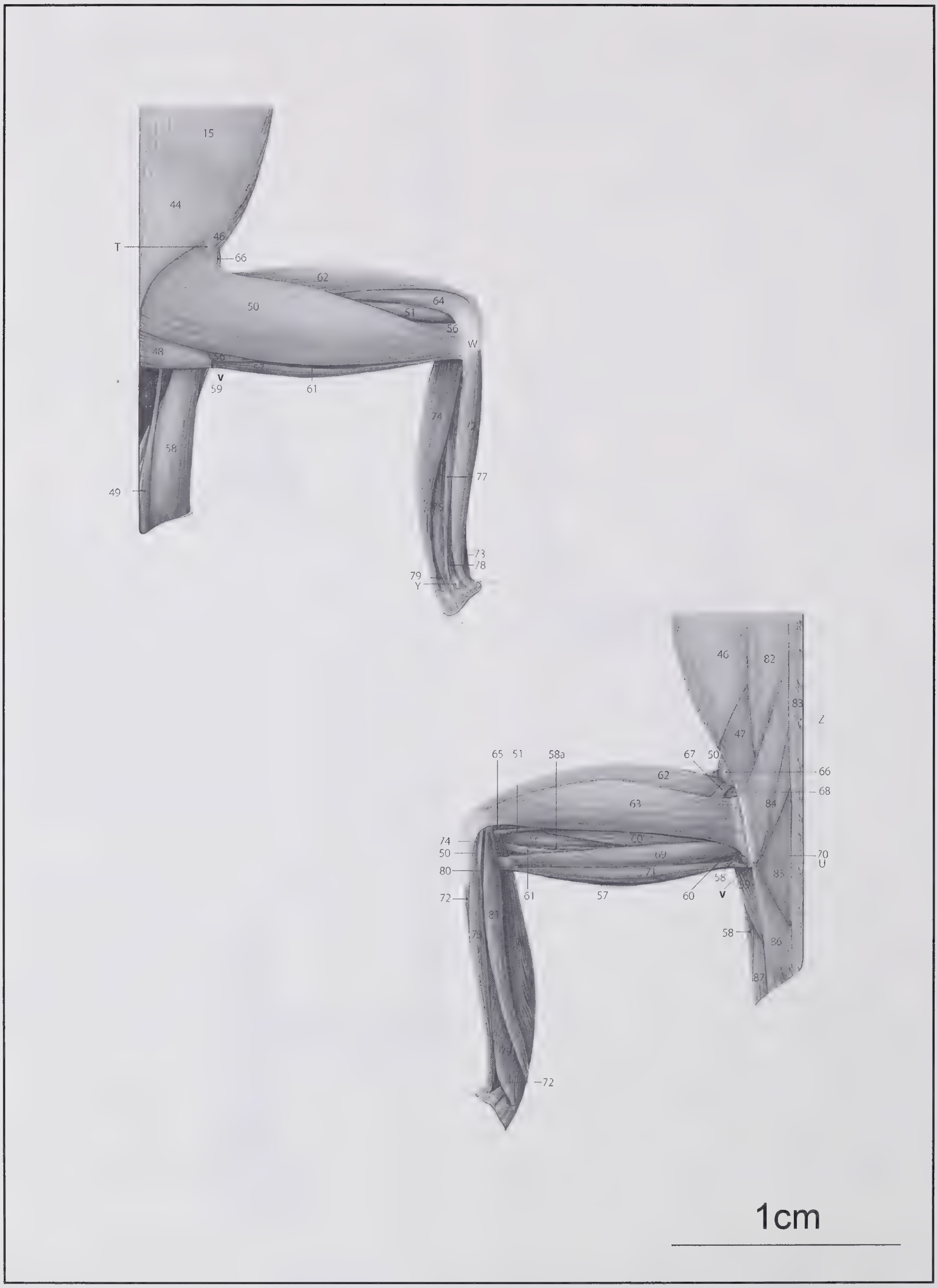

Figure 6. Anatomical drawings illustrating the superficial hindlimb musculature in *A. sagrei.* Shown are a ventral and dorsal view (top and bottom, respectively). 15. M. pectoralis pars superficialis. 44. M. rectus abdominis pars superficialis. 45. M. rectus abdominis pars profundus. 46. M. obliquus abdominis. 47. M. transversus abdominis complex. 48. M. transversus perinei. 49. M. cocygeus inferior. 50. M. puboischiotibialis. 51. M. pubofibularis. 56. M. flexor tibialis externus. 57. M. flexor tibialis internus. 58. M. caudofemoralis longus; 58a. tendino m. caudofemoralis longus. 59. M. caudofemoralis brevis. 60. M. adductor femoris. 61. M. ilioischiofibularis. 62. M. ambiens pars ventralis. 63. M. ambiens pars dorsalis. 64. M. femorotibialis pars ventralis. 65. M. femorotibialis pars dorsalis. 66. M. pubofemoralis pars dorsalis externus. 67. M. pubofemoralis pars dorsalis internus. 68. M.

head. Proposed function: femoral protraction/moment arm changes.

M. ischiofemoralis posterior (53): originates at the posterolateral ventral side of the ischium. A number of fibers originate at the anterolateral part of the ischium, superficial to the fibers of the M. ischiofemoralis anterior. The muscle inserts at the dorsocaudal part of the femoral head. Proposed function: femoral retraction.

M. pubofemoralis pars ventralis (54): originates at the entire ventral surface of the pubis and partially also from the medial puboischiadic ligament. The muscle inserts ventrally on the proximal aspect of the trochanter. Proposed function: femoral adduction.

M. ischiofemoralis anterior (55): originates at the cartilaginous anterolateral aspect of the ischium, the medial puboischiadic ligament and the medioventral edge of the pubis. The muscle inserts at the ventral aspect of the base of the trochanter. Proposed function: femoral adduction.

M. flexor tibialis externus (56): originates at the ventral side of the ilioischiadic ligament and runs from its origin toward the tibia, where the muscle inserts on the ventral side of the tibial head by means of a short aponeurosis. This is the most superficially positioned muscle originating from the ilioischiadic ligament. Proposed function: femoral adduction. Note that this muscle is typically considered a knee flexor (Higham and Jayne, 2004; Snyder, 1954). However, given its attachment at the knee joint, this muscle does not appear to result in knee flexion in the species studied here.

M. flexor tibialis internus (57): originates at the ilioischiadic ligament, but deep, dorsal, and caudal to the M. flexor tibialis externus. This is the most caudally positioned of the four muscles originating in this area. The fibers run slightly outward and insert by means of a tendon at the ventral, cranial side of the tibia, distal to the insertion of the M. flexor tibialis externus. Near its origin it runs adjacent to the M. iliotibialis. Proposed function: knee flexion and femoral adduction.

M. caudofemoralis longus (58): originates at the ventral processi, the ventral side of the vertebral body, and the ventral side of the transverse processi of caudal vertebrae 2–8 (2–9 in *A. valencienni*). The muscle runs dorsal to the ilioischiadic ligament and inserts by means of a short and thick tendon on the cranial face of the femur, just distal to the trochanter. An accessory tendon splits off from the main tendon and runs toward the tibia, where it inserts just distal to the knee joint. In *A. valencienni*, the insertion is shifted more distally. Proposed function: femoral retraction.

M. caudofemoralis brevis (59): originates at the ventral side of the vertebral body and at the transverse processi of caudal vertebrae 1–4. The muscle lies external to the M. caudofemoralis longus and inserts on the ilioischiadic ligament. Proposed function: ilioischiadic ligament tension/changing moment arm of the M. caudofemoralis longus.

M. adductor femoris (60): the proximal fibers originate at the caudal aspect of the lateral puboischiadic ligament, the intermediate fibers at the ventral aspect of the ischium, and the more caudal fibers laterally at the caudal side of the ischium. A small group of fibers originating on the ilioischiadic ligament also join the rest of

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ischiofemoralis dorsalis pars anterior. 69. M. iliofibularis. 70. M. iliofemoralis. 71. M. ilioischiotibialis. 72. M. tibialis anterior. 73. M. extensor digitorum longus. 74. M. gastrocnemius pars major. 75. M. gastrocnemius pars minor. 77. M. flexor digitorum communis. 78. M. extensor ossi metatarsi hallucis. 79. M. peroneus brevis. 80. M. popliteus. 81. M. peroneus longus. 82. M. longissimus. 83. M. spinalis. 84. M. iliocostalis. 85. M. longus cauda. 86. M. iliocaudalis. 87. M. ischiocaudalis. V, ligamentum ilioischiadum; T, pectineal tubercle; U, ilium; W, tibia; X, fibula; Y, astragalocalcaneum; Z, processus spinosus vertebra. * Deeper structures, not labeled.

the muscle. The fibers run outward and insert along the distal three quarters of the femur. Proposed function: femoral adduction.

M. ilioischiofibularis (61): originates at the ilioischiadic ligament and the ilium, cranial to the M. iliotibialis. The muscle runs dorsal to the M. flexor tibialis externus. The muscle inserts by means of a clear tendon at the cranialmost aspect of the fibula. Proposed function: femoral adduction.

M. ambiens (62, 63): has a bipartite origin; the dorsal group of fibers (pars dorsalis) originates by means of a wide aponeurosis along the ascending first half of the ilium (=iliotibialis; in Snyder, 1954). The ventral group of fibers (pars ventralis) originates by means of a short aponeurosis at the base of the pubis and the proximalmost aspect of the trochanter. The muscle runs dorsal to the aponeurosis communis and inserts by means of a short, thick aponeurosis that runs across the knee joint and inserts on the proximal aspect of the tibia. Together with the Mm. femorotibiali (dorsal and ventral parts), the M. ambiens forms the M. quadriceps femoris. Proposed function: knee extension.

M. femorotibialis ventralis (64): originates along the distal two-thirds of the femur. The muscle inserts by means of a tendon at the cranial side of the tibia. Proposed function: knee extension.

M. femorotibialis dorsalis (65): originates at the dorsal side of the femur and inserts by means of a short tendon at the dorsolateral side of the tibia. Proposed function: knee extension.

M. pubofemoralis pars dorsalis (66, 67): the externus part originates at the dorsocranial side of the pubis. The muscle partly inserts on the aponeurosis communis (the externalmost fibers coming from the tip of the pubis) and partly on the femur (internus part), just distal to the trochanter. Proposed function: femoral protraction.

M. ischiofemoralis dorsalis anterior (68): originates at the dorsal side of the ischium, runs dorsad, curves around the pubis, runs anterior to the articulation with the femur, and inserts at the cranial aspect of the femur just distal to the trochanter. Proposed function: femoral protraction.

M. iliofibularis (69): originates at the base of the ilium just anterior to the posterior ascending process. The muscle inserts at the fibula by means of a thin tendon, deep to the dorsalmost part of the M. gastrocnemius. Proposed function: knee flexion.

M. iliofemoralis (70): is a narrow muscle that originates at the anterior ventrolateral part of the ilium and inserts proximally on the caudal aspect of the femur at the level of the insertion of the M. caudofemoralis longus. Proposed function: femoral abduction.

M. ilioischiotibialis (71): originates at the dorsolateral aspect of the ilioischiadic ligament. The muscle inserts by means of a clear tendon that splits at the level of the M. gastrocnemius. The first part of the tendon inserts proximally on the ventromedial side of the tibia, the other part runs across the tibial part of the M. gastrocnemius and inserts proximally on the ventrolateral side of the tibia. Proposed function: knee flexion.

M. tibialis anterior (72): has two clear bellies. The first one originates at the anterior aspect of the tibia, whereas the second originates on the ventral aspect of the entire tibia. The insertion of both parts is on the lateral aspect of the first metatarsal. Proposed function: ankle flexion.

M. extensor digitorum longus (73): originates by means of a long thin tendon on the fibular side of the femur. It inserts at the dorsal side of the third metatarsal. Proposed function: ankle flexion.

M. gastrocnemius (74–76): consists of two parts:

1) M. gastrocnemius pars profundus (76): the tibial deep part originates at the distal part of the femur on the tibial side. This is the smallest of the two parts and is reduced in *A. valencienni.* It inserts by means of a tendon that crosses to the other side, runs under the plantar aponeurosis,

and inserts medially at the level of the fifth metatarsal.

2) M. gastrocnemius pars fibularis: This is the most prominent part of the M. gastrocnemius and is positioned on the fibular side. It originates on the dorsal tubercle of the femur on the fibular side by means of a thick tendon. This muscle belly can be split into two parts. The pars major (74) inserts onto the first phalanx of the fourth and fifth toe; the pars minor (75) inserts on the first phalanx of the fourth toe. Proposed function: ankle extension.

M. flexor digitorum communis (77): consists of two parts. The tibial part originates fleshy at the proximal third along the inner aspect of both tibia and fibula. The fibular part originates at the proximal third along the inner part of the fibula. The two bellies converge onto a tendon that wraps around the ankle. The tibial part inserts by means of a long narrow tendon on the distal phalanges of toes 1–4. The fibular part inserts by means of a long thin tendon at the distal phalanx of the fifth toe. Proposed function: ankle extension and toe flexion.

M. extensor ossi metatarsi hallucis (78): originates at the ventral side of the distal two thirds of the fibula and inserts by means of a short tendon on the dorsal aspect on the tibial side of the astragalocalcaneum. Proposed function: ankle extension and rotation.

M. peroneus brevis (79): originates from the distal two thirds of the cranial edge of the fibula and inserts at the posterodorsal side of the fifth metatarsal. Proposed function: ankle extension.

M. popliteus (80): originates at the mesial side of the most proximal part of the fibula. The muscle runs obliquely ventrad to insert on the mesial side of the proximal fifth of the tibia. Proposed function: tibio-fibular rotation.

M. peroneus longus (81): originates by means of a long, narrow tendon on the fibular side of the femur. The muscle wraps around the ankle and inserts at the ventral side of the fifth metatarsal. Proposed function: ankle extension.

M. iliofemoralis posterior (not drawn): originates from the posterior part of the ilium (at the level of the attachment of the ilioischiadic ligament) and from the ventral aspect of the first caudal vertebra. The muscle inserts onto the femur, proximal to the tendon of the M. caudofemoralis longus. Proposed function: femoral abduction.

M. ischiofemoralis dorsalis posterior (not drawn): originates at the dorsocaudal side of the ischium and inserts at the dorsocaudal side of the femur. Proposed function: femoral abduction.

M. pronator profundus (not drawn): originates fleshy at the distal quarter on the mesial aspect of the fibula. The muscle runs obliquely ventrad and inserts on the mesial side of the distal fifth of the tibia. Proposed function: tibio-fibular rotation.

Morphometrics

The *A. valencienni* in our sample were significantly larger than the *A. sagrei* (SVL: $F_{1,16} = 68.35$, $P < 0.001$). However, for its body size, *A. sagrei* had significantly longer tibia (analyses of covariance with SVL as covariate; slope: $F_{1,6} = 1.28$, $P = 0.30$; intercept: $F_{1,7} = 15.32$, $P = 0.006$), metatarsi (slope: $F_{1,6} = 0.23$, $P = 0.65$; intercept: $F_{1,7} = 6.59$, $P = 0.037$) and toes on both front limbs (slope: $F_{1,6} = 1.16$, $P = 0.32$; intercept: $F_{1,7} = 16.89$, $P = 0.005$) and hindlimbs (slope: $F_{1,6} = 0.35$, $P = 0.58$; intercept: $F_{1,7} = 7.48$, $P = 0.029$) compared with *A. valencienni*. These results are consistent with previous analyses of limb dimensions in these species (Beuttell and Losos, 1999; Higham et al., 2001).

Muscle Mass and Muscle Mass distribution (Table 1)

The two species differed significantly in total hindlimb (ANOVA: $F_{1,8} = 13.79$, $P = 0.004$) and total forelimb ($F_{1,8} = 25.67$, $P = 0.001$) muscle mass, with *A. sagrei* having heavier fore- and hindlimb muscles than *A. valencienni* despite its smaller

TABLE 1. SUMMARY TABLE OF THE ANALYSIS OF MUSCLE MASSES AND MUSCLE MASS DISTRIBUTIONS IN *A. SAGREI* AND *A. VALENCIENNI*.

	Anolis sagrei	*Anolis valencienni*
Snout–vent length (mm)	55.79 ± 1.88	66.26 ± 2.52
Total hindlimb muscle mass (mg)	393.03 ± 74.80	278.60 ± 25.41
Total forelimb muscle mass (mg)	209.07 ± 38.16	125.33 ± 16.36
Femur protractors (mg)	33.00 ± 17.35	17.20 ± 10.37
Femur retractors (mg)	83.84 ± 23.07	78.52 ± 27.39
Femur abductors (mg)	6.31 ± 2.08	5.14 ± 1.01
Femur adductors (mg)	49.44 ± 18.83	28.26 ± 11.96
Knee flexors (mg)	49.93 ± 22.38	38.72 ± 17.62
Knee extensors (mg)	57.98 ± 20.25	32.08 ± 14.00
Ankle flexors (mg)	14.10 ± 6.82	5.43 ± 2.35
Ankle extensors (mg)	49.21 ± 27.05	18.04 ± 9.33
Other hindlimb (mg)	3.42 ± 3.78	3.24 ± 2.07
Humerus retractors (mg)	81.99 ± 44.94	39.60 ± 18.32
Humerus protractors (mg)	10.33 ± 2.15	8.40 ± 5.53
Humerus abductors (mg)	13.52 ± 4.9	7.94 ± 2.88
Humerus adductors (mg)	12.48 ± 6.67	8.46 ± 3.73
Elbow flexors (mg)	20.91 ± 7.33	9.46 ± 3.97
Elbow extensors (mg)	24.82 ± 10.51	13.17 ± 6.92
Wrist flexors (mg)	11.24 ± 4.93	5.86 ± 3.02
Wrist extensors (mg)	7.13 ± 3.41	4.76 ± 4.00
Other forelimb (mg)	2.22 ± 1.25	1.47 ± 0.84

Table entries are means ± standard deviation.

body size. Absolute differences in most functional groups tended to be nonsignificant. However, the ankle extensors ($F_{1,8}$ = 8.11, P = 0.022), ankle flexors ($F_{1,8}$ = 9.94, P = 0.014), and elbow flexors ($F_{1,6}$ = 7.25, P = 0.036) were significantly heavier in *A. sagrei.* Femur adductors ($F_{1,8}$ = 4.22, P = 0.07) and knee extensors ($F_{1,8}$ = 4.87, P = 0.058) were generally (but not significantly) larger in *A. sagrei* compared to *A. valencienni.*

The femur retractors are the largest muscle group in the hindlimb, followed by the knee extensors and flexors (Fig. 10A). Whereas the femur retractors are relatively larger in *A. valencienni* (i.e., relative to total limb muscle mass; $F_{1,7}$ = 27.30, P = 0.001), the knee extensors ($F_{1,7}$ = 9.16, P = 0.019) and ankle extensors ($F_{1,7}$ = 13.25, P = 0.008) are relatively bigger in *A. sagrei.* In the forelimb, the humerus retractors are the biggest muscle group, and these are somewhat, but not significantly, better developed in *A. sagrei* compared with *A. valencienni* (Fig. 10B). In general, species-specific differences in forelimb muscle mass distribution are much smaller than for the hindlimb. The proportions of hindlimb and forelimb muscle mass relative to the total muscle mass were similar for both species (hindlimb, ±70%; forelimb, ±30%).

Locomotor Behavior

In the two-way MANCOVA with stride length, stride frequency, and step length as

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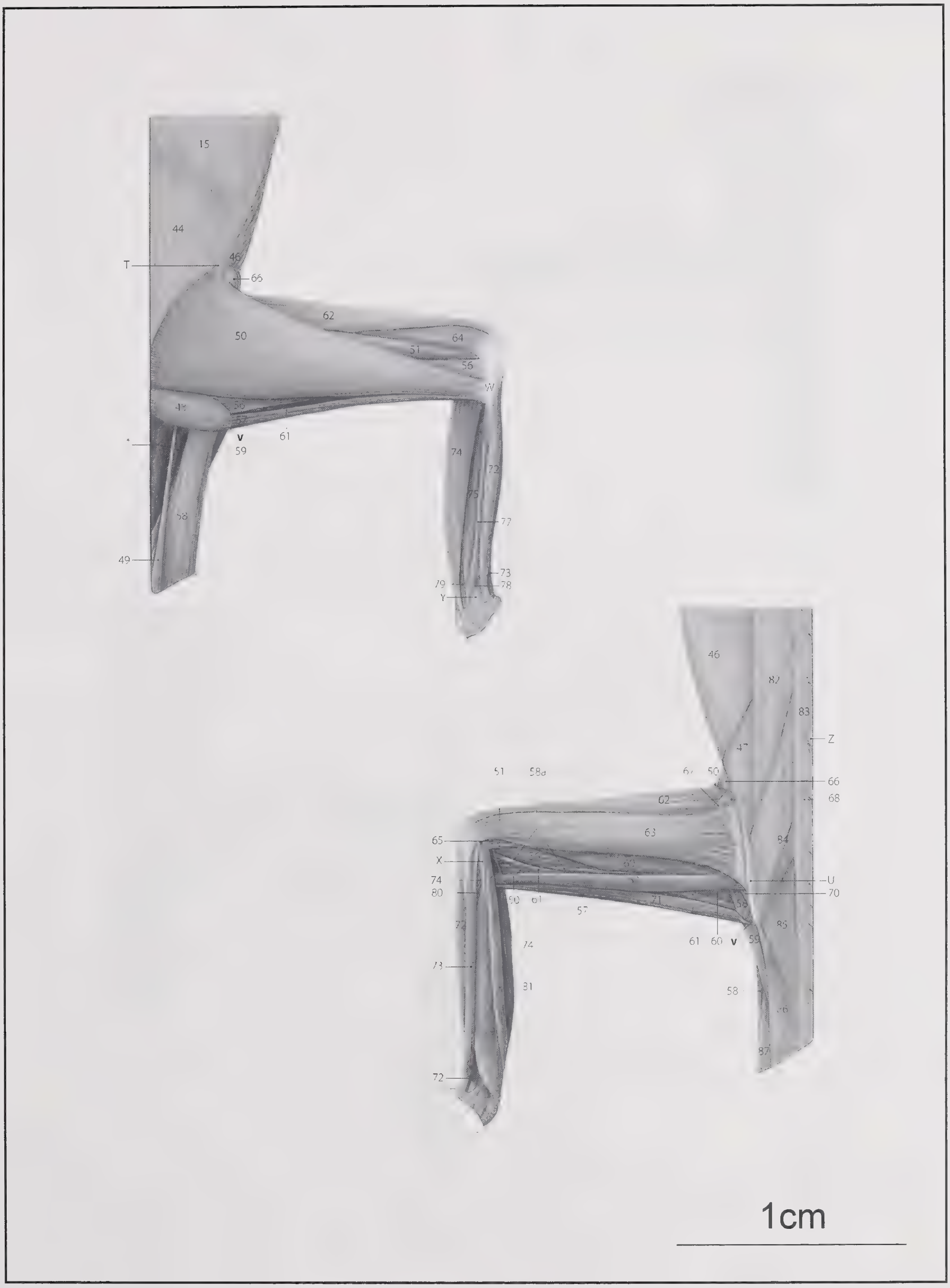
Figure 7. Anatomical drawings illustrating the superficial hindlimb musculature in *A. valencienni.* Shown are a ventral and dorsal view (top and bottom, respectively). Note the generally more robust musculature in *A. sagrei* as depicted in Figure 6. 15. M. pectoralis pars superficialis. 44. M. rectus abdominis pars superficialis. 45. M. rectus abdominis pars profundus. 46. M. obliquus abdominis. 47. M. transversus abdominis complex. 48. M. transversus perinei. 49. M. cocygeus inferior. 50. M. puboischiotibialis. 51. M. pubofibularis. 56. M. flexor tibialis externus. 57. M. flexor tibialis internus. 58. M. caudofemoralis longus; 58a. tendino m. caudofemoralis longus. 59. M. caudofemoralis brevis. 60. M. adductor femoris. 61. M. ilioischiofibularis. 62. M. ambiens pars



ventralis. 63. M. ambiens pars dorsalis. 64. M. femorotibialis pars ventralis. 65. M. femorotibialis pars dorsalis. 66. M. pubofemoralis pars dorsalis externus. 67. M. pubofemoralis pars dorsalis internus. 68. M. ischiofemoralis dorsalis pars anterior. 69. M. iliofibularis. 70. M. iliofemoralis. 71. M. ilioischiotibialis. 72. M. tibialis anterior. 73. M. extensor digitorum longus. 74. M. gastrocnemius pars major. 75. M. gastrocnemius pars minor. 77. M. flexor digitorum communis. 78. M. extensor ossi metatarsi hallucis.79. M. peroneus brevis. 80. M. popliteus. 81. M. peroneus longus. 82. M. longissimus. 83. M. spinalis. 84. M. iliocostalis. 85. M. longus cauda. 86. M. iliocaudalis. 87. M. ischiocaudalis. V, ligamentum ilioischiadum; T, pectineal tubercle. U, ilium. W, tibia. X, fibula. Y, astragalocalcaneum. Z, processus spinosus vertebra. * Deeper structures, not labeled.

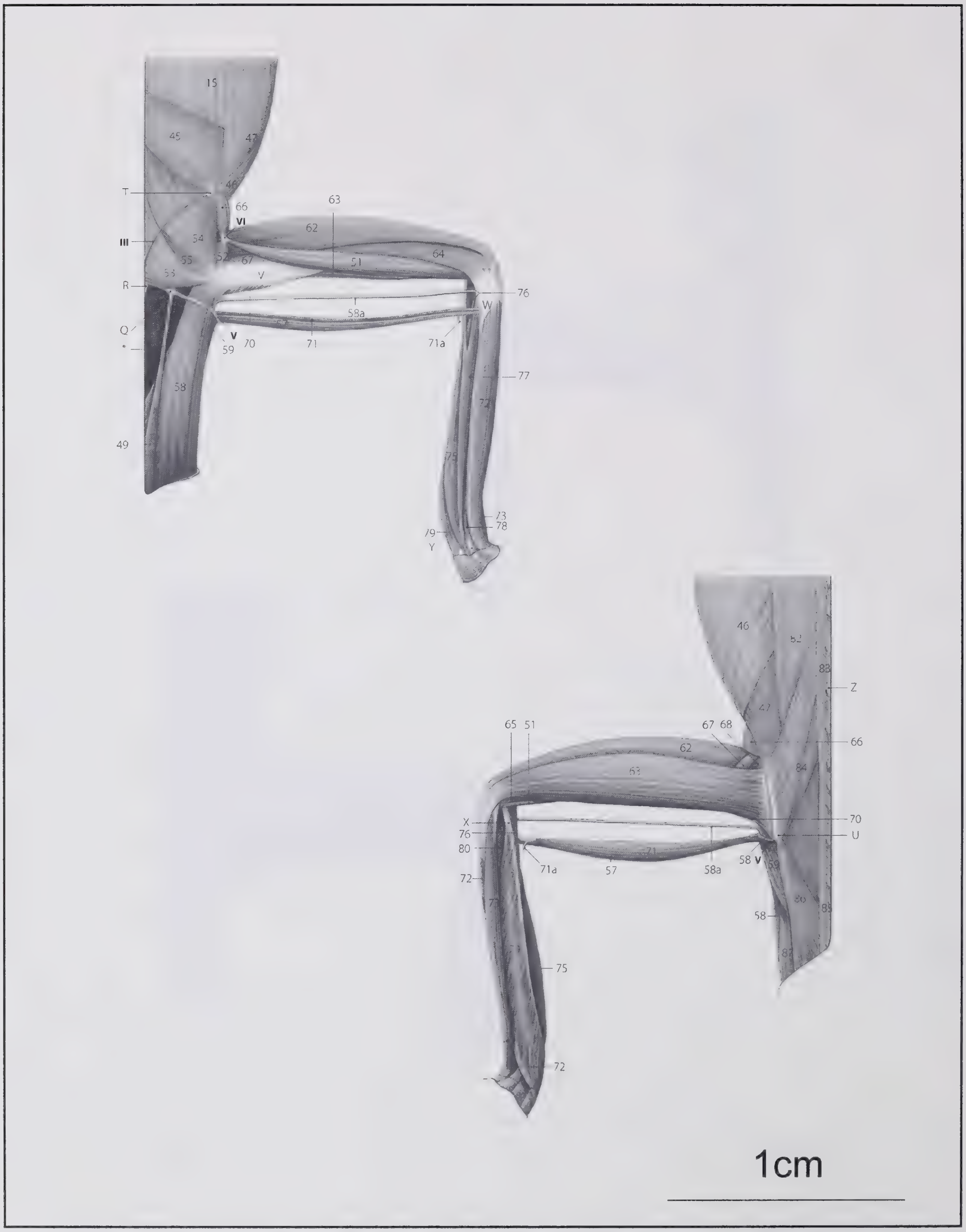


Figure 8. Anatomical drawings illustrating the deep hindlimb musculature in *A. sagrei.* Shown are a ventral and dorsal view (top and bottom, respectively). 15. M. pectoralis pars superficialis. 45. M. rectus abdominis pars profundus. 46. M. obliquus abdominis. 47. M. transversus abdominis complex. 49. M. cocygeus inferior. 51. M. pubofibularis. 52. M. tensor aponeurosis communis. 53. M. ischiofemoralis pars posterior. 54. M. pubofemoralis pars ventralis. 55. M. ischiofemoralis pars anterior. 57. M. flexor tibialis internus. 58. M. caudofemoralis longus; 58a. tendino m. caudofemoralis longus. 59. M. caudofemoralis brevis. 62. M. ambiens pars ventralis. 63. M. ambiens pars dorsalis. 64. M. femorotibialis pars ventralis. 65. M. femorotibialis pars dorsalis. 66. M. pubofemoralis pars dorsalis externus. 67. M. pubofemoralis pars dorsalis internus. 68. M. ischiofemoralis dorsalis pars anterior. 70. M. iliofemoralis. 71. M. ilioischiotibialis; 71a. tendino m. ilioischiotibialis. 72. M. tibialis anterior. 73. M. extensor digitorum longus. 75. M. gastrocnemius pars minor. 76. M. gastrocnemius pars profundus. 77. M. flexor digitorum communis.

dependent variables, stride speed as covariate and species and dowel as factor, none of the interaction effects were significant (all $P > 0.07$). Average velocity over a stride had a significant effect on the spatiotemporal gait characteristics (Wilks' $\lambda = 0.044$, $F_{3,6} = 42.99$, $P < 0.0001$). In addition, gait characteristics differed significantly between species (Wilks' $\lambda = 0.064$, $F_{3,6} = 29.02$, $P = 0.001$; Fig. 11). For a given speed, *A. sagrei* takes longer strides and longer steps at lower frequencies compared with *A. valencienni*. Differences between substrates were also significant (Wilks' $\lambda = 0.086$, $F_{3,6} = 21.36$, $P = 0.001$; Fig. 11). Locomotion on broad dowels was associated with higher step and stride lengths, but lower stride frequencies compared with narrow dowels. Univariate *F* tests showed that species and substrate effects were highly significant for all parameters tested (Table 2).

DISCUSSION

A number of distinct and striking differences in the morphology of the pectoral girdle and associated appendicular musculoskeletal system were observed when comparing two distinct *Anolis* species. The pectoral girdle itself, for example, is relatively narrower and longer in *A. valencienni* compared with *A. sagrei* and is reflected in the more gracile overall body shape in the former species (see also Beuttell and Losos, 1999). The difference in body shape itself can be related to selection for increased stability on narrow substrates in *A. valencienni* (Losos and Irschick, 1996; Losos and Sinervo, 1989). Additionally, it allows this species and other twig anoles with a similar body shape to remain cryptic against its preferred substrate of narrow branches and twigs (Huyghe et al., 2007; Irschick and Losos, 1996; Vanhooydonck et al., 2007).

Our results on muscle mass show that total forelimb muscle mass is considerably greater in *A. sagrei* despite its smaller body size (Table 1). Although not different in absolute size, the relative contribution of the humerus retractors to the total forelimb muscle mass is greater (but not significantly so) in this species as well. This was unexpected given the subordinate role of the forelimbs during locomotion on horizontal substrates, more characteristic of the habitat use of *A. sagrei,* and the importance of humerus retraction during climbing (Zaaf et al., 1999, 2001), which is expected to be associated with the more arboreal lifestyle of *A. valencienni.* However, twig anoles like *A. valencienni,* despite being highly arboreal, do spend a significant proportion of their time on horizontal or inclined substrates (Irschick and Losos, 1996; Mattingly and Jayne, 2004, 2005). Thus, humerus retraction might be less important for these species than initially expected. *Anolis sagrei,* on the other hand, although spending a considerable amount of time on the ground, does run up the vertical bases of tree trunks (i.e., trunk-ground anoles use steeper surfaces than other ecomorphs; Mattingly and Jayne, 2004) which might explain the importance of humerus retraction in this species. The significantly greater absolute mass of the elbow flexors (also important during climbing) in *A. sagrei* corroborates this finding. Additional data on other trunk-ground versus twig anoles are needed, however, to test the generality of these findings.

As predicted a priori, the anatomy of the hindlimb muscles also differs between the two species, with a larger absolute overall

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78. M. extensor ossi metatarsi hallucis. 79. M. peroneus brevis. 80. M. popliteus. 82. M. longissimus. 83. M. spinalis. 84. M. iliocostalis. 85. M. longus cauda. 86. M. iliocaudalis. 87. M. ischiocaudalis. III, ligamentum puboischiadum pars lateralis; V, ligamentum ilioischiadum; VI, aponeurosis communis; Q, ischium; R, hypoischium; T, pectineal tubercle; U, ilium; V, femur; W, tibia; X, fibula; Y, astragalocalcaneum; Z, processus spinosus vertebra. * Deeper structures, not labeled.

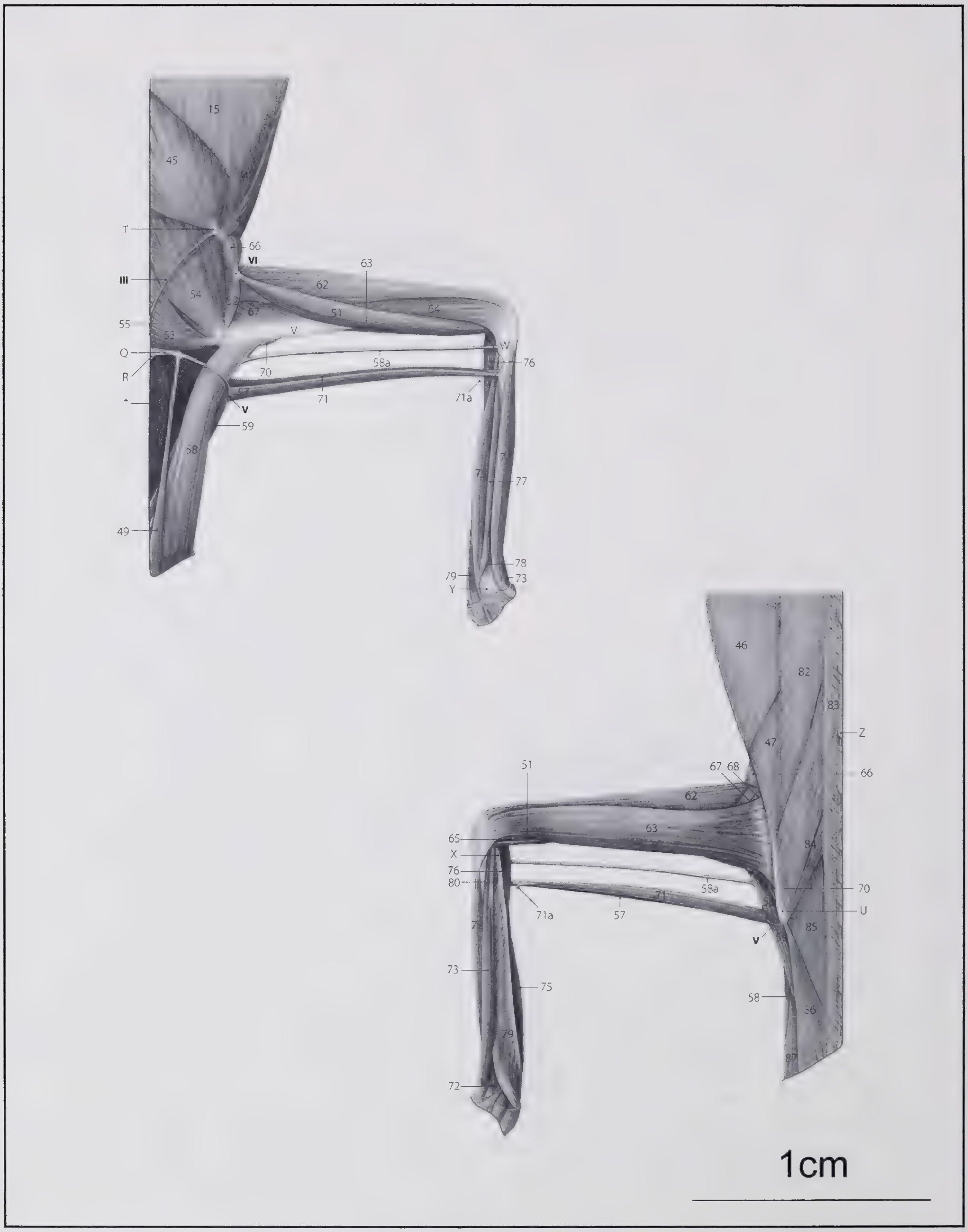

Figure 9. Anatomical drawings illustrating the deep hindlimb musculature in *A. valencienni.* Shown are a ventral and dorsal view (top and bottom, respectively). Note the subtle differences in the insertion of the m. caudofemoralis and its accessory tendon in *A. valencienni* compared with *A. sagrei,* as depicted in Figure 8. 15. M. pectoralis pars superficialis. 45. M. rectus abdominis pars profundus. 46. M. obliquus abdominis. 47. M. transversus abdominis complex. 49. M. cocygeus inferior. 51. M. pubofibularis. 52. M. tensor aponeurosis communis. 53. M. ischiofemoralis pars posterior. 54. M. pubofemoralis pars ventralis. 55. M. ischiofemoralis pars anterior. 57. M. flexor tibialis internus. 58. M. caudofemoralis longus; 58a. tendino m. caudofemoralis

TABLE 2. SUMMARY OF UNIVARIATE ANALYSIS ON SIZE-CORRECTED GAIT CHARACTERISTICS FOR *A. SAGREI* AND *A. VALENCIENNI* MOVING ON TWO DIFFERENT SUBSTRATES.

	df	*F*	*P*
Dowel			
Stride length	1, 8	24.41	0.001
Stride frequency	1, 8	40.28	<0.0001
Step length	1, 8	14.02	0.006
Species			
Stride length	1, 8	55.25	<0.0001
Stride frequency	1, 8	11.98	0.009
Step length	1, 8	8.48	0.02
Stride speed			
Stride length	1, 8	0.26	0.62
Stride frequency	1, 8	22.63	0.001
Step length	1, 8	3.68	0.09

Note that all kinematic variables were expressed relative to hindlimb length. *df*, degrees of freedom.

hindlimb muscle mass as well as significantly larger ankle extensors and ankle flexors observed in *A. sagrei* (Table 1). Muscle mass allocation also differed significantly between species, with *A. sagrei* having relatively larger knee and ankle extensors and *A. valencienni* having relatively larger femur retractors. Also, the shape of the pelvic girdle shows remarkable differences in the two species. Whereas the pelvis is longer and narrower in *A. valencienni,* the ilium is elongated and inclined more dorsally in *A. sagrei* (see also Beuttell and Losos, 1999). Whereas the overall shape differences in the pelvis can be related to overall differences in body shape (longer and narrower in *A. valencienni*), the differences in ilial structure can be directly related to differences in locomotor mode. The ilium is the principal area of insertion for the knee extensors, and the knee extensors are the principal determinants of variation in sprint speed, jump, and acceleration capacity in *Anolis* lizards (James et al., 2007; Vanhooydonck et al., 2006a). The longer the ilium, the more space is available for the knee extensors. Indeed, *A. sagrei* has more massive knee extensors in both absolute and relative terms compared with *A. valencienni. Anolis valencienni,* on the other hand, appears to rely more on femoral retraction, as suggested by the relatively greater allocation of muscle mass to femur retractors and the distal shift of the insertion of the M. caudofemoralis, thus providing for a greater moment arm and, consequently, moment around the hip joint.

Given the importance of keeping the center of mass close to the middle of the substrate when running on narrow branches, relying on knee extension for propulsion could effectively be less optimal because of the induced lateral displacement away from the center of the branch, at least when the foot is positioned at the lev-

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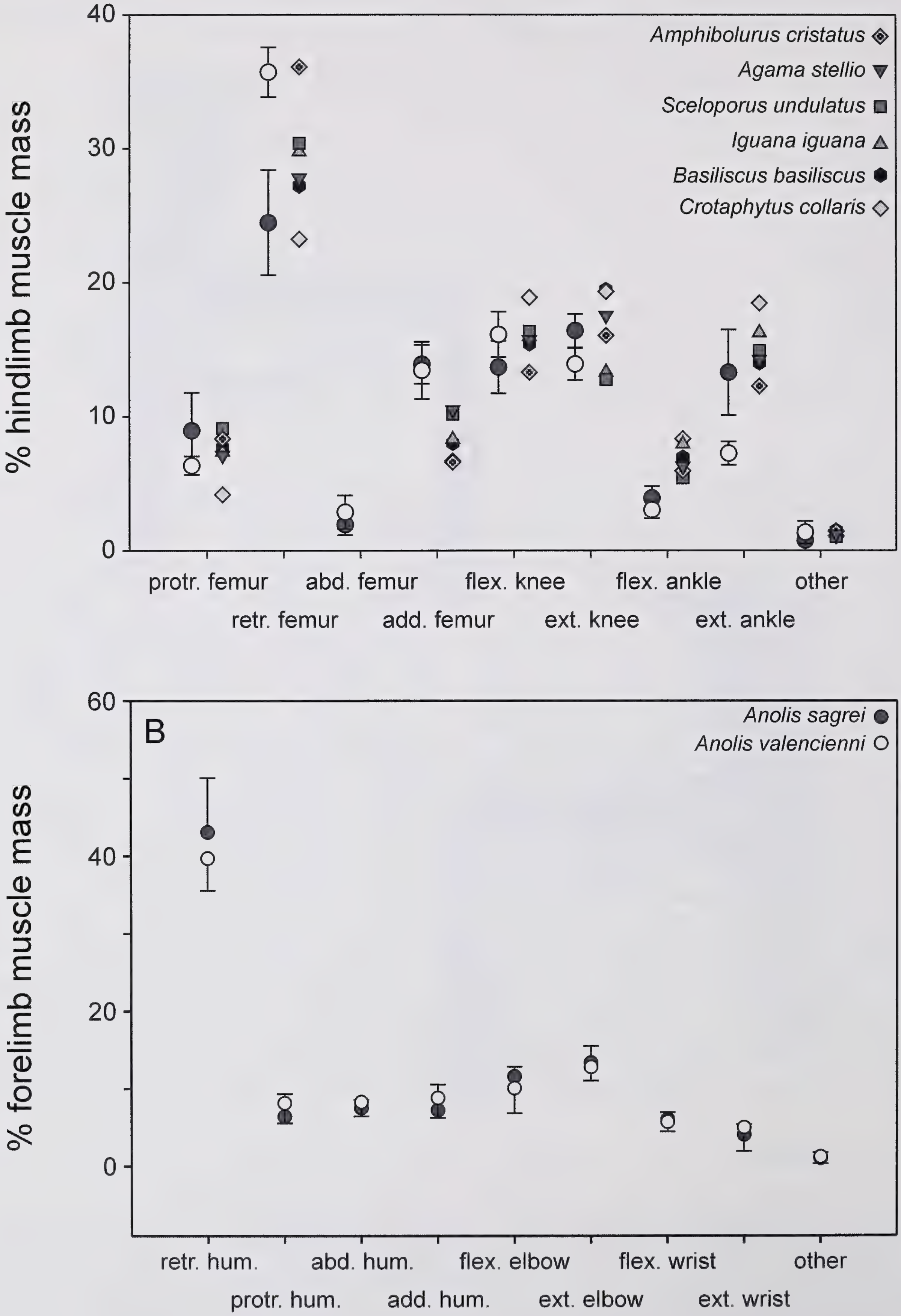
longus. 59. M. caudofemoralis brevis. 62. M. ambiens pars ventralis. 63. M. ambiens pars dorsalis. 64. M. femorotibialis pars ventralis. 65. M. femorotibialis pars dorsalis. 66. M. pubofemoralis pars dorsalis externus. 67. M. pubofemoralis pars dorsalis internus. 68. M. ischiofemoralis dorsalis pars anterior. 70. M. iliofemoralis. 71. M. ilioischiotibialis; 71a. tendino m. ilioischiotibialis. 72. M. tibialis anterior. 73. M. extensor digitorum longus. 75. M. gastrocnemius pars minor. 76. M. gastrocnemius pars profundus. 77. M. flexor digitorum communis. 78. M. extensor ossi metatarsi hallucis. 79. M. peroneus brevis. 80. M. popliteus. 82. M. longissimus. 83. M. spinalis. 84. M. iliocostalis. 85. M. longus cauda. 86. M. iliocaudalis. 87. M. ischiocaudalis. III, ligamentum puboischiadum pars lateralis; V, ligamentum ilioischiadum; VI, aponeurosis communis; Q, ischium; R, hypoischium; T, pectineal tubercle; U, ilium; V, femur; W, tibia; X, fibula; Y, astragalocalcaneum; Z, processus spinosus vertebra. * Deeper structures, not labeled.


% hindlimb muscle mass
0
10
20
30
40
Amphibolurus cristatus
Agama stellio
Sceloporus undulatus
Iguana iguana
Basiliscus basiliscus
Crotaphytus collaris
protr. femur
retr. femur
abd. femur
add. femur
flex. knee
ext. knee
flex. ankle
ext. ankle
other
B
% forelimb muscle mass
0
20
40
60
Anolis sagrei
Anolis valencienni
retr. hum.
protr. hum.
abd. hum.
add. hum.
flex. elbow
ext. elbow
flex. wrist
ext. wrist
other

el of or in front of the pelvis (Spezzano and Jayne, 2004). This appears to be reflected in the morphology of the hindlimb muscles and locomotor patterns in the two species. Indeed, an additional important difference between the two species in locomotor style is the reduced protraction of the limb during the swing phase in *A. valencienni,* causing it to take smaller steps and strides and resulting in a placement of the foot behind the pelvic girdle. Again, this can be coupled to differences in hindlimb morphology between the two species. The insertion of the accessory tendon of the M. caudofemoralis is displaced more distally from the knee joint in *A. valencienni,* thus effectively preventing knee extension when the femur is protracted. The morphology is however different in *A. sagrei,* with the insertion being at the level of the joint, thus allowing knee extension and femur protraction at the same time. This results in greater step and stride lengths and ultimately also sprint speeds. The cost of the greater protraction and dependence on knee extension is a potential decrease in stability because of the greater lateral displacement of the center of mass away from the center of the branch.

A comparison of our data on muscle mass distribution with previously published data for several species of iguanid (sensu lato) and agamid lizards indicates that the differences between the two species of anole included here are nearly as great as between a dedicated terrestrial lizard (*Crotaphytus collaris*) and an exclusively arboreal species (*Iguana iguana*) (see Fig. 10A). Moreover, differences observed between the two anole ecomorphs tend to mimic those (although being different in absolute terms) observed between the terrestrial and the arboreal species, with *A. sagrei* being more similar to *C. collaris* and *A. valencienni* being more similar to *I. iguana.* Among iguanid lizards, *Sceloporus undulatus,* being semi-arboreal, resembles *A. valencienni* and *I. iguana* in its muscle mass distribution. *Basiliscus basiliscus,* being ecologically more similar to *A. sagrei* in that it uses both arboreal and terrestrial substrates, is generally intermediate between the more dedicated ground dweller *C. collaris* and the arboreal *I. iguana.* Among the agamid lizards, *Amphibolurus cristatus* (now placed in the genus *Ctenophorus*) is unusual in that it resembles more arboreal lizards like *I. iguana* and *A. valencienni* in some features of the hindlimb muscle mass distribution, despite being a largely terrestrial lizard. Like *A. valencienni* and *I. iguana, A. cristatus* appears to rely predominantly on femur retraction rather than knee and ankle extension for generating propulsion. Clearly, data for additional agamid and iguanid lizards are need to investigate the generality of these patterns and to quantitatively test for associations between muscle morphology and habitat use in a comparative context.

Our data show how an understanding of the morphology of the locomotor apparatus might help explain the correlated evolution of morphology, performance, locomotor style (i.e., gait characteristics) and habitat use in *Anolis* lizards. In providing this detailed morphological account, we hope to provide a basis for future studies investigating the morphology of the musculoskeletal system and its role in the evolution of locomotor performance and habitat use in *Anolis* lizards and to show that morphological adaptations to habitat use go beyond mere external differences in limb size and shape.

←

Figure 10. Graphs illustrating the relative muscle mass distribution expressed as the proportion of the total hindlimb (A) or forelimb (B) muscle mass. Data are represented as means ± standard deviation for the two *Anolis* species included in our study. Whereas differences in muscle mass allocation are strikingly different for the hindlimb muscles, differences for the forelimb are less conspicuous. Solid circles, *A. sagrei*; white circles, *A. valencienni.* Also plotted are literature data on hindlimb muscle mass distribution taken from Snyder (1954). Note, however, that Snyder did not consider femur abductors.

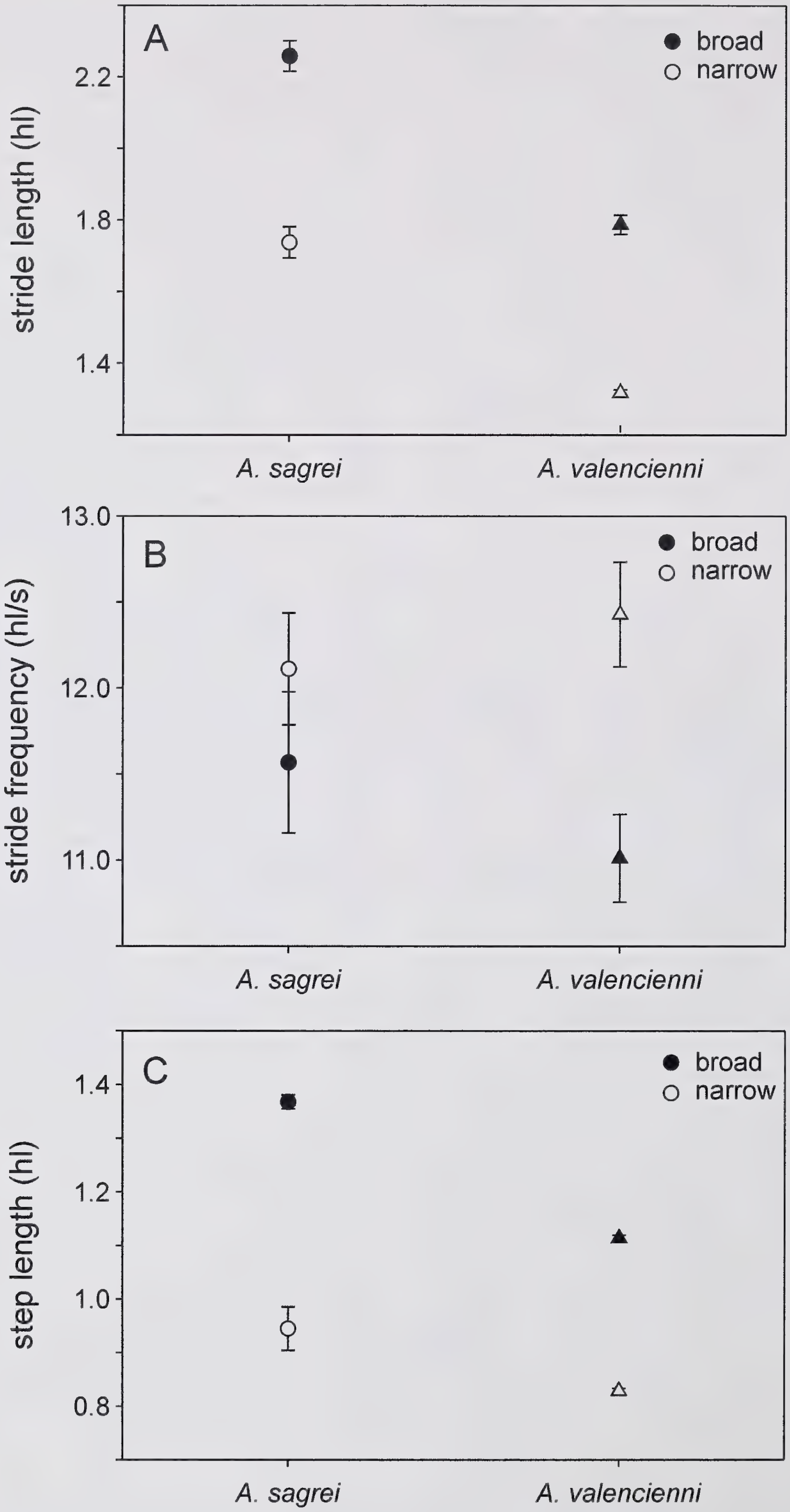


Figure 11. Graphs illustrating the differences in spatiotemporal gait characteristics in *A. sagrei* and *A. valencienni* while moving across two different substrates. Data are represented as means ± standard deviation. Illustrated are the stride length (A), stride frequency (B), and step length (C) expressed in hindlimb lengths. Thus, for a given hindlimb length, *A. sagrei* takes larger steps and strides on both substrates. Broad substrates are associated with greater step and stride lengths and lower stride frequencies in both species. hl, hindlimb.

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Bulletin OF THE
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Scientific Results of the *Hassler* Expedition. Bryozoa. No. 1 Barbados

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SCIENTIFIC RESULTS OF THE *HASSLER* EXPEDITION. BRYOZOA. NO. 1. BARBADOS

JUDITH E. WINSTON[1] AND ROBERT M. WOOLLACOTT[2]

CONTENTS

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ABSTRACT. An unidentified collection of bryozoans made by L. F. Pourtalès and L. Agassiz during the *Hassler* Expedition (1871–1872) was recently discovered in the teaching collection of the Invertebrate Paleontology Department at the Museum of Comparative Zoology, Harvard University. Bryozoan samples found included stations from Barbados to Brazil and around the coast of South America to La Jolla, California.

The first and most successful deepwater collecting of bryozoans was done early in the expedition at two stations (146 m and 183 m) off Barbados, on December 29 and 30, 1871. Thirty-one taxa of bryozoans were collected at the Barbados stations: five cyclostomes and 26 cheilostomes, including one new genus. None of the cyclostomes was reproductive, so taxa could not be identified to species level. Of the 26 cheilostomes, 16 represent new species: *Caberea hassleri*, *Cellaria louisorum*, *Exochella tropica*, *Smittoidea reginae*, *Parasmittina barbadensis*, *Parkermavella salebrosa*, *Hippoporina rutelliformis*, *Metroperiella agassizi*, *Stylopoma haywardi*, *Barbadiopsis trepida*, *Gemelliporina hastata*, *Buffonellaria ensifera*, *Cigclisula gemmea*, *Rhynchozoon sexaspinatum*, *Stephanollona propinqua*, and *Reteporellina directa*. All species found are described and illustrated with scanning electron microscope photographs. Bryozoans of the *Hassler* Expedition are now incorporated into the collections of the Department of Marine Invertebrates of the Museum of Comparative Zoology.

INTRODUCTION

This report concerns a small collection of bryozoans from the island of Barbados located in the Lesser Antilles chain bordering the Caribbean Sea. The specimens were obtained as part of an expedition conducted in 1871–1872 and initiated by Benjamin Peirce, then superintendent of the United States Coast Survey (Anonymous, 1871). Peirce commissioned construction on the Atlantic Coast of the iron-hulled 165-foot steamer *Hassler* for use in hydrographic surveys on the Pacific Coast of North America. The ship, therefore, needed to be moved to San Francisco, the site of its first positioning. Jean Louis Rodolphe Agassiz (founder of the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA) accepted an invitation from Peirce to lead a scientific expedition of Agassiz's design during the ship's circumnavigation of South America from Boston to San Francisco. The ship was staffed with Navy Department personnel headed by Commander P. C. Johnson, but Agassiz was permitted to select nonmilitary scientists and assistants for the expedition (Peirce, 1871). The scientific contingent included Agassiz; Mr. James Blake, assistant and artist; Dr. Thomas Hill, a physicist and former president of Harvard College; Louis Francois de Pourtalès, Esq., scientist in charge of dredging and collecting; Dr. Franz Steindachner, an ichthyologist; and Mr. J. William White, assistant. Agassiz's wife, Elizabeth Cary Agassiz, as well as the wife of Commander P. C. Johnson, also accompanied the expedition (Agassiz, E.C., 1872; Peirce, 1871).

Louis Agassiz had grand visions for the significance of this expedition. In letters soliciting funds for costs of the scientific component of the expedition, Agassiz wrote: "... the results of this voyage will be as important for the increase of our knowledge of the characteristics of the sea, as the voyages of Capt. Cook were, a century ago, for the improvement of navigation and geography" (Agassiz, L., 1871). Time would

prove, however, that Agassiz's dreams were not realized for the most part.

The voyage began in Boston on 4 December, 1871, and concluded in San Francisco on 30 August 1872. During the course of the cruise numerous stops were made, some planned and some unplanned.

That portion of the expedition relevant to this study concerns circumstances surrounding collections made off Barbados on 29 and 30 December, 1871. Unless noted otherwise, the account given here was taken in large measure from E. C. Agassiz's narrative of the voyage (Agassiz, E. C., 1872) and L. F. de Pourtalès' official summary of the expedition written for the U.S. Coast Survey (Pourtalès, 1875).

The *Hassler* departed St. Thomas on 22 December and headed toward the islands of Santa Cruz, Montserrat, and Guadaloupe to conduct benthic sampling at the deepest depths possible. Heavy seas, however, made such dredging impossible. On 26 December, one of the air chambers of the auxiliary steam pump failed and could not be repaired at sea. The captain elected to head for an unplanned destination, Barbados, where in the city of Bridgetown the engine could be refurbished. They sighted Barbados around 5:00 p.m. that afternoon and anchored later that evening off Bridgetown. Repairs began the following morning and were completed on the afternoon of 29 December. During this interval, Agassiz's group went ashore for touring and collecting.

On the afternoon of 29 December, the *Hassler* steamed 5 or 6 miles up the coast from Bridgetown to Sandy Bay. At this time, measurements of the amounts of light present with varying depth were made by Dr. Hill and a series of dredge hauls were undertaken. The ship returned to Bridgetown that evening, but traveled again the following day back to Sandy Bay for an all-day dredging trip (Blake, 1871–1872). The dredge hauls were wonderfully successful in the eyes of Agassiz. Blake reports "Prof A. said he would be contented if we got nothing else" (Blake, 1871–1872). Especially important finds to Agassiz were specimens of particular sponges, crinoids, echinoids, and an extremely rare living specimen of the gastropod genus *Pleurotomaria* (Malacology Catalogue number MCZ 119057). These hauls also yielded 31 species of bryozoans, which are described for the first time in this report. Sixteen of the 31 are new species, and there is one new genus. The *Hassler* departed its unscheduled detour to Barbados about 5:00 p.m. on 30 December and sailed toward Rio de Janeiro, the next destination on the expedition itinerary.

STUDY AREA AND METHODS

The small (34 km long by 18 km wide) coral–limestone island of Barbados is the easternmost island of the Lesser Antilles volcanic arc, an area extending from the Virgin Islands to Tobago.

The Barbados lots studied here were among the specimens of bryozoans collected during the *Hassler* Expedition (1871–1872). Bryozoan material from the *Hassler* was discovered in the paleontology teaching collection in the Museum of Comparative Zoology (MCZ) in the early 2000s and transferred to the Department of Marine Invertebrates. All of the material was uncatalogued and specimens were unidentified with the exception of a single lot. Remaining bryozoan lots obtained from other locales visited by this expedition will be treated in forthcoming publications.

The Barbados lots were received as several boxes of dry specimens with labels indicating the depth at which they had been collected (80 or 100 fm), but otherwise unsorted except as "Bryozoa". Specimens from each depth were rinsed in freshwater and dried. They were then examined under a dissecting microscope and sorted, or detached from larger substrata when necessary. The processed specimens were given preliminary taxonomic identifications and placed in plastic boxes approved for collections storage. From each sorted lot one or more colonies or colony fragments were selected for study and digital imaging using scanning electron microscopy (SEM). Stan-

dard measurements were made on at least one colony of each taxon found. Measurements were made using a Wild stereomicroscope with 20× oculars (magnification = 100×). The measurements included dimensions of the following characters if present: zooid length (Lz), zooid width (Wz), opesia length (Lop), opesia width (Wop), primary orifice length (Lo), primary orifice width (Wo), orifice diameter (Diam.o) for round orifices, secondary orifice length (Lo2), secondary orifice width (Wo2), ovicell length (Lov), ovicell width (Wov), avicularian length (Lav), avicularian width (Wav).

RESULTS

Species Found

Barbados 80 fm (146 m)
- *Antropora typica*
- *Buffonellaria ensifera*
- *Caberea hassleri*
- *Cellaria louisorum*
- *Crisia* sp.
- *Exochella tropica*
- *Hippoporina rutelliformsis*
- *Metroperiella agassizi*
- *Microporella protea*
- *Patinella* sp.
- *Proboscina robusta*
- *Puellina smitti*
- *Rhynchozoon sexaspinatum*
- *Steginoporella connexa*
- *Stomatopora* sp.
- *Stylopoma haywardi.*
- *Stylopoma smitti*
- *Tervia* sp.
- *Trematooecia turrita*

Barbados, 100 fm (183 m)
- *Barbadiopsis trepida*
- *Bryopesanser pesanseris*
- *Buffonellaria ensifera*
- *Buskea minutiporosa*
- *Cigclisula gemmea*
- *Gemelliporina hastata*
- *Lagenicella verrucosa*
- *Parkermavella salebrosa*
- *Metroperiella agassizi*
- *Microporella protea*
- *Parasmittina barbadensis*
- *Reteporellina directa*
- *Smittoidea reginae*
- *Steginoporella magnilabris*
- *Stephanollona propinqua*
- *Stomatopora* sp.

SYSTEMATICS

Class Stenolaemata
Order Cyclostomata
Family Crisiidae Johnston, 1838
Genus *Crisia* Lamouroux, 1812
Crisia sp.
Figure 1

Description. Colony erect, white, jointed, slightly curving biserial branches (Fig. 1A) and long internodes (12–15 zooids per internode). Zooids long and tubular, their calcified walls sparkling with relatively large, evenly spaced pseudopores. Distal portion of zooid tubes curving slightly up and outward from the branch, orifices round to oval (Fig. 1B). Bases rami, the initiation points of side branches, occur above the third to seventh zooid from the base of an internode. Chitinous joints between internodes black. Tubular attachment kenozooids about 0.9–0.10 mm in diameter grow from the abfrontal side of some of the branches. The colony fragments found did not have gonozooids.

	Measurements		
	Range	Mean	*N*
Lz	0.491–0.819	0.646	6
Wz	0.109–0.127	0.121	6
Lo	0.055–0.073	0.067	6
Wo	0.073–0.082	0.074	6
Wbranch	0.264–0.309	0.281	6

Notes. The morphology and dimensions of zooids and branch internodes are quite similar to those described for *Crisia denticulata* (Lamarck, 1816). However, as Hayward and Ryland (1985, p. 54) point out, "Despite the distinctive appearance of this species, with the jet black joints and wedged-in basis rami being especially clear characters, the name *denticulata* has been widely applied to almost any coarsely

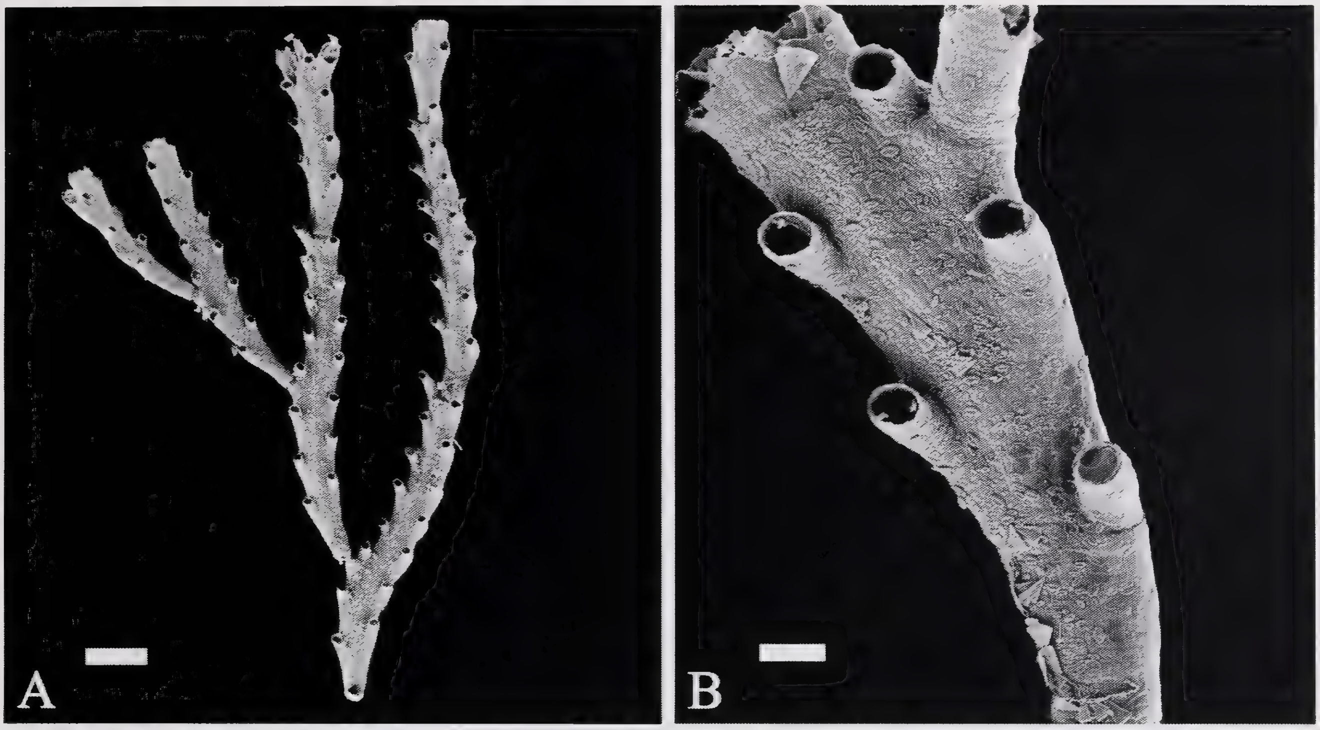

Figure 1. *Crisia* sp. Hassler Box 4. A. Branches of colony. Scale bar = 500 µm. B. Zooids, showing size of tubes and orifice shape. Scale bar = 100 µm. MCZ 100108.

straggling, long internode species, causing confusion on a par with that for *C. eburnea*." The Barbados material is also similar in colony and zooid size, internode length, and dark joint coloration to *Crisia ficulnea* (Buge, 1979) from Brazil. However, since the material examined lacked gonozooids, we identify it here only as *Crisia* sp.

Distribution. Barbados.

Specimens Examined. MCZ 100108. Hassler Box 4, Barbados, 80 fm. December 1871.

Family Oncousoeciidae Canu, 1918
Genus *Stomatopora* Bronn, 1825
Stomatopora sp.
Figures 2, 4D

Description. Colony white, encrusting, uniserial, sparsely dichotomously branching, spreading over and among colonies of bryozoans and other calcareous substrata (Figs. 2 A–D). Zooids narrow, elongate, concentrically wrinkled tubes, impossible to measure more than approximately because of their curvature or their distortion by underlying substratum topography (Fig. 2E). Calcification with transverse striations and numerous small pseudopores that show a sieve platelike ultrastructure when highly magnified (5,000×, Fig. 2F). Orifices small, round, raised slightly in short peristomes from the recumbent portions of zooids. No gonozooids found.

Measurements

	Range	Mean	*N*
Lz	0.892–1.183	0.995	3
Wz	0.182–0.200	0.194	3
Diam.o	0.109–0.164	0.133	3

Notes. The *Stomatopora trahens* described by Lagaaij (1963, p. 208) is very similar to the Barbados material in morphology. Only one branching point occurs in the Barbados colony, and it is broken on one side, but the angle of branching is similar, as are the proportions of zooids and orifices. However, it has since been shown (Hayward and Ryland, 1985, p. 60 and Fig. 39B) that *S. trahens* of Couch (1841, p.71) is merely an early growth stage of *Entalophoroecia deflexa* (Couch) 1842. True *Stomatopora* species, mostly from deepwater habitats, have a gonozooid in the form of a small sac budded from the end of the peristome, with a narrow oeciostome projecting from it (Harmelin, 1974, Hayward and Ryland, 1985). The

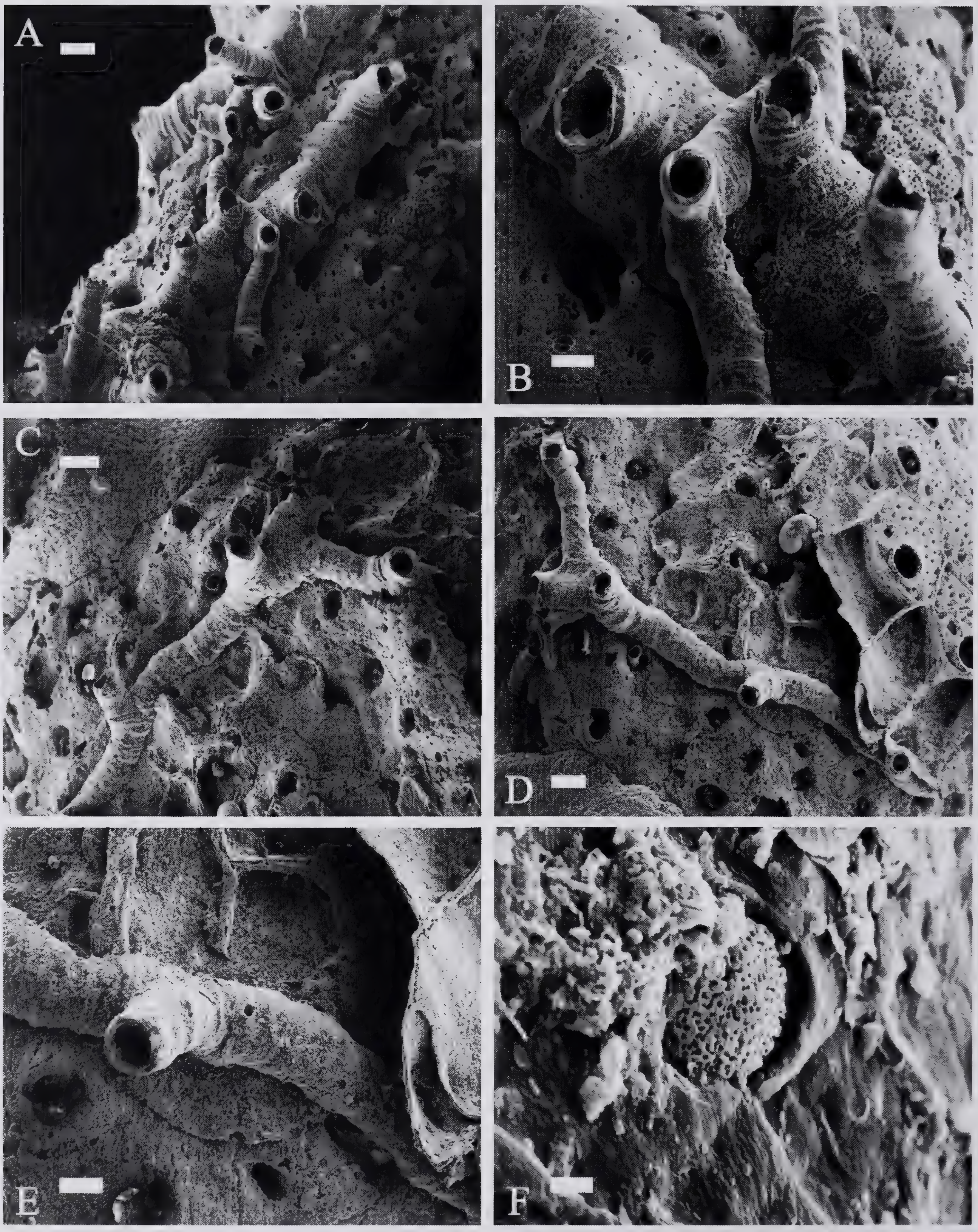

Figure 2. *Stomatopora* sp. (A–E Hassler Box 2. MCZ 100109) A. *Stomatopora* colony creeping over *Proboscina robusta* colony. Scale bar = 200 μm. B. Overlap of the two species. Scale bar = 100 μm. MCZ 100109. C. Another colony, scale bar = 200 μm. D. Partly overgrown colony. Scale bar = 200 μm. E. Close-up of single zooid of *Stomatopora* being overgrown by *Hippoporina rutelliformis*. Scale bar =100 μm. F. (Hassler Box 6. MCZ 100112) Pincushion pore plates. Scale bar = 2 μm.

specimen from Barbados, and Lagaaij's specimen also, have proportionally longer tubes and smaller diameter orifices than seen in the encrusting phases of other erect tubuliporids. They may represent a new species of *Stomatopora*, but lacking gonozooids they cannot be described further.

Distribution. Barbados.

Specimens Examined. MCZ 100109. Hassler Box 2, Barbados, 80 fm. December 1871. MCZ 100110. Hassler Box 6, Barbados, 100 fm. December 1871.

Genus *Proboscina* Audouin, 1826
Proboscina robusta Canu & Bassler, 1928
Figures 3, 4

Proboscina robusta Canu & Bassler, 1928a: 157, pl. 30, fig. 7, 1928b: 100, pl. 9, fig. 4.
Proboscina robusta, Osburn, 1947: 3. Buge, 1979: 219, pl. 2, fig. 2.

Description. Colony white, encrusting, composed of a series of large tubular zooids in biserial to multiserial arrangement (Figs. 3A–C). Zooids adherent to substratum for most of their length, but with distal vertically projecting peristomes, ending in round to oval openings. Calcification heavy relative to some other cyclostomes (e.g., the *Crisia* sp. above), with wrinkled appearance due to numerous transverse striations, and a surface speckled by pseudopores, which at a high magnification (5,000×) show a spokelike arrangement of denticles (Figs. 4B, C). Gonozooids forming in lobate multiserial expansions of the colony, with same pseudopore ultrastructure as autozooid tubes (Figs. 3D–F). Those collected here were found on a very abraded colony, and the oeciostome could not be determined with certainty, but is likely the narrow proximally facing tube showing in Figures 3E and F.

Measurements

	Range	Mean	*N*
Lz	0.437–0.801	0.576	6
Wz	0.309–0.382	0.352	6
Diam.o	0.109–0.146	0.129	6

Notes. Both zooid dimensions and pseudopore ultrastructure contrast with those of *Stomatopora* sp. Figure 4D shows portions of adjacent zooid tubes of the two species at 700× for comparison.

Distribution. Caribbean, Brazil.

Specimens Examined. MCZ 100111. Hassler Box 2, Barbados, 80 fm. December 1871. MCZ 100112. Hassler Box 6, Barbados, 100 fm. December 1871.

Family Terviidae Canu & Bassler, 1920
Genus *Tervia* Jullien, 1882
Tervia sp.
Figure 5

Description. Colony white, erect, and dichotomously branching (Fig. 5A). Zooid tubes opening on frontal and frontal-lateral surface, and with an abfrontal surface marked by crescentic transverse striations. Zooids tubular, their boundaries obscured by their curving and transversely striated calcification, but with distal ends raised and curved away from the branch axis as oval to subangular peristomes. Pseudopore ultrastructure consisting of simple angular to rounded openings (Fig. 5D). The colony fragment present in the Barbados material is not complete but shows on its abfrontal surface a swelling (broken off basally) that may be a gonozooid, with a possible oeciostome at its distal end (Figs. 5C–E).

Measurements

	Range	Mean	*N*
Lz	0.746–1.056	0.904	6
Wz	0.328–0.382	0.349	6
Lo	0.191–0.246	0.224	6
Wo	0.164–0.182	0.179	6

Notes. SEM images appear flatter than the view of the same specimen through a light microscope. In light microscope view the curving horizontal striations are much more noticeable as is the ridged very three-dimensional shape of the branches. No *Tervia* species have been described from the Western Atlantic–Caribbean region. According to Harmelin (1976) and Hayward and Ryland (1985), the eastern Atlantic species, *Tervia irregularis* (Meneghini) 1844, prefers deep water (100 m+) and detritic deposits of the continental shelves, which agrees well with

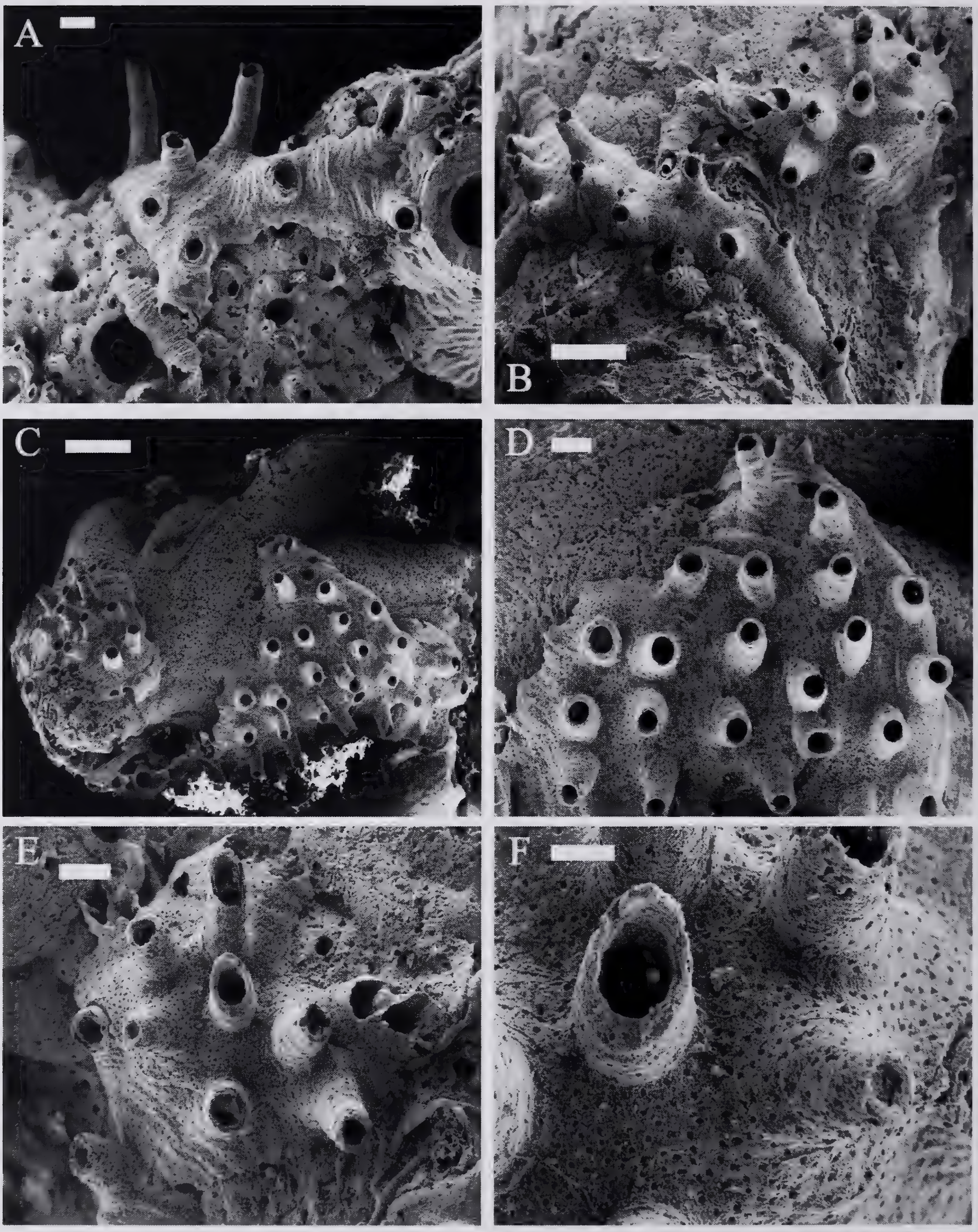

Figure 3. *Proboscina robusta-1*. Hassler Box 6. MCZ 100112. A. Portion of encrusting colony. Scale bar = 200 μm. B. Expansion of zooid rows into lobes. Scale bar = 500 μm. C. View of two lobes of colony. Scale bar = 500 μm. D. Close-up of left lobe. Scale bar = 200 μm. E. Lobe with possible gonozooid. Scale bar = 200 μm. F. Close-up of gonozooid. Scale bar = 50 μm.

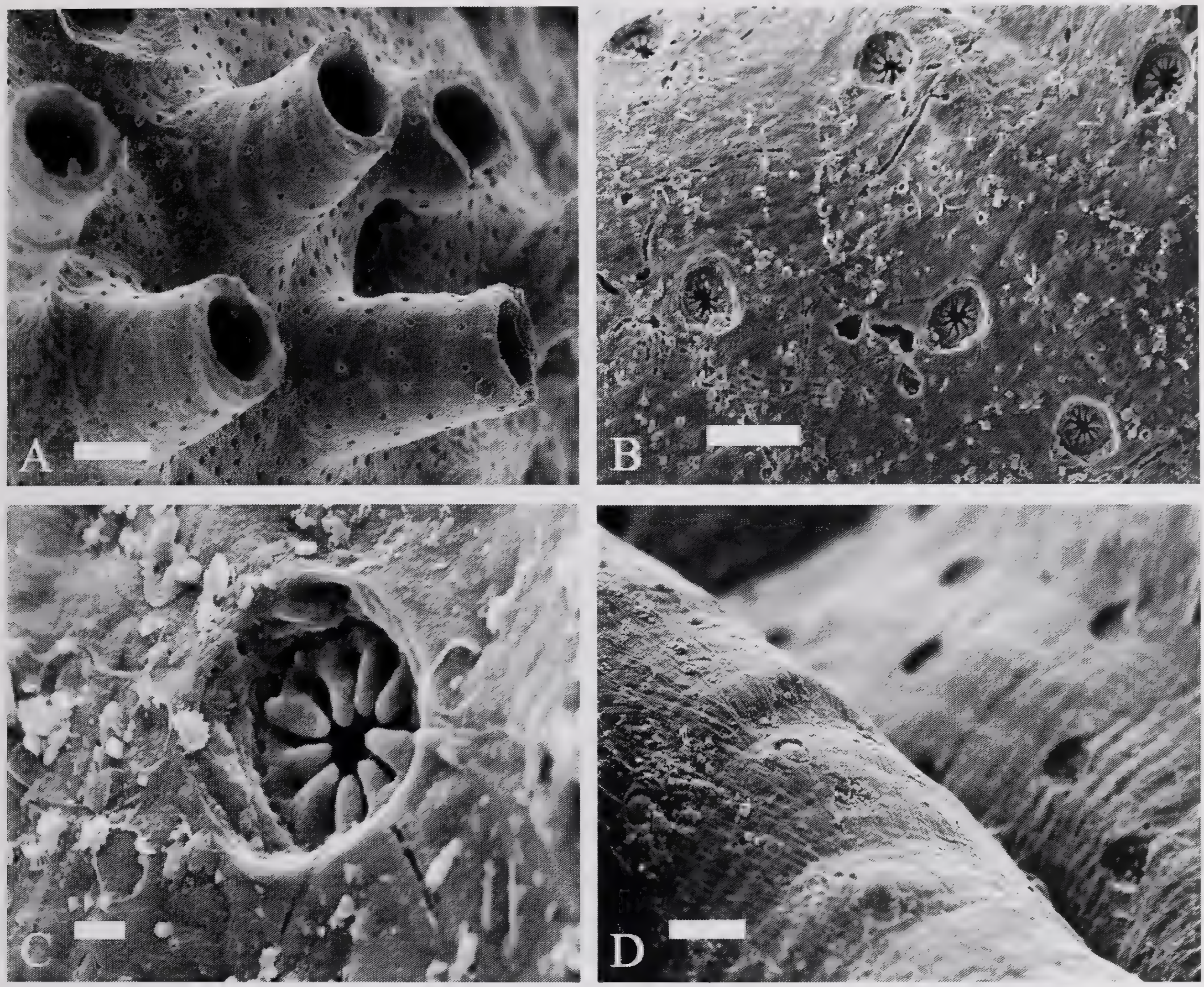

Figure 4. *Proboscina robusta-2*. A. Close-up of pores on zooid peristomes and colony surface. Scale bar = 100 µm. B. Magnified view of pores showing radial denticles. Scale bar = 10 µm. C. Highly magnified pore. Scale bar = 1 µm. D. Direct comparison of pore structure of *Stomatopora* (on left) and *Proboscina* (on right) zooids. Scale bar = 10 µm.

the depth and habitat in which the Barbados specimen was found.

Distribution. Barbados, 100 fm.

Specimens Examined. MCZ 100113. Hassler Box 7, Barbados, 100 fm. December 1871.

Family Lichenoporidae Smitt, 1867
Genus *Patinella* Gray, 1848
Patinella sp.
Figure 6

Description. Colony rounded in outline, the raised central area of spiny zooids interspersed with alveolar spaces is surrounded by a flat peripheral lamina (Figs. 6A, B). Zooid tubes radiating outward from colony center, upper surfaces with knobby keels, their terminal openings with scalloped projections (Fig. 6B). Colony skeleton, including that of the basal lamina, with a pustulose texture due to tiny rounded bumps of calcification (Fig. 6C). No gonozooids present on Barbados specimens.

Measurements

	Range	Mean	*N*
Lz	0.291–0.364	0.328	6
Wz	0.109–0.146	0.123	6
Lo	0.073–0.100	0.088	6
Wo	0.055–0.091	0.070	6

Notes. Figure 6A shows what appear to be two subcolonies regenerated from a damaged or senescent older colony. As there are no gonozooids on this composite colony, it is

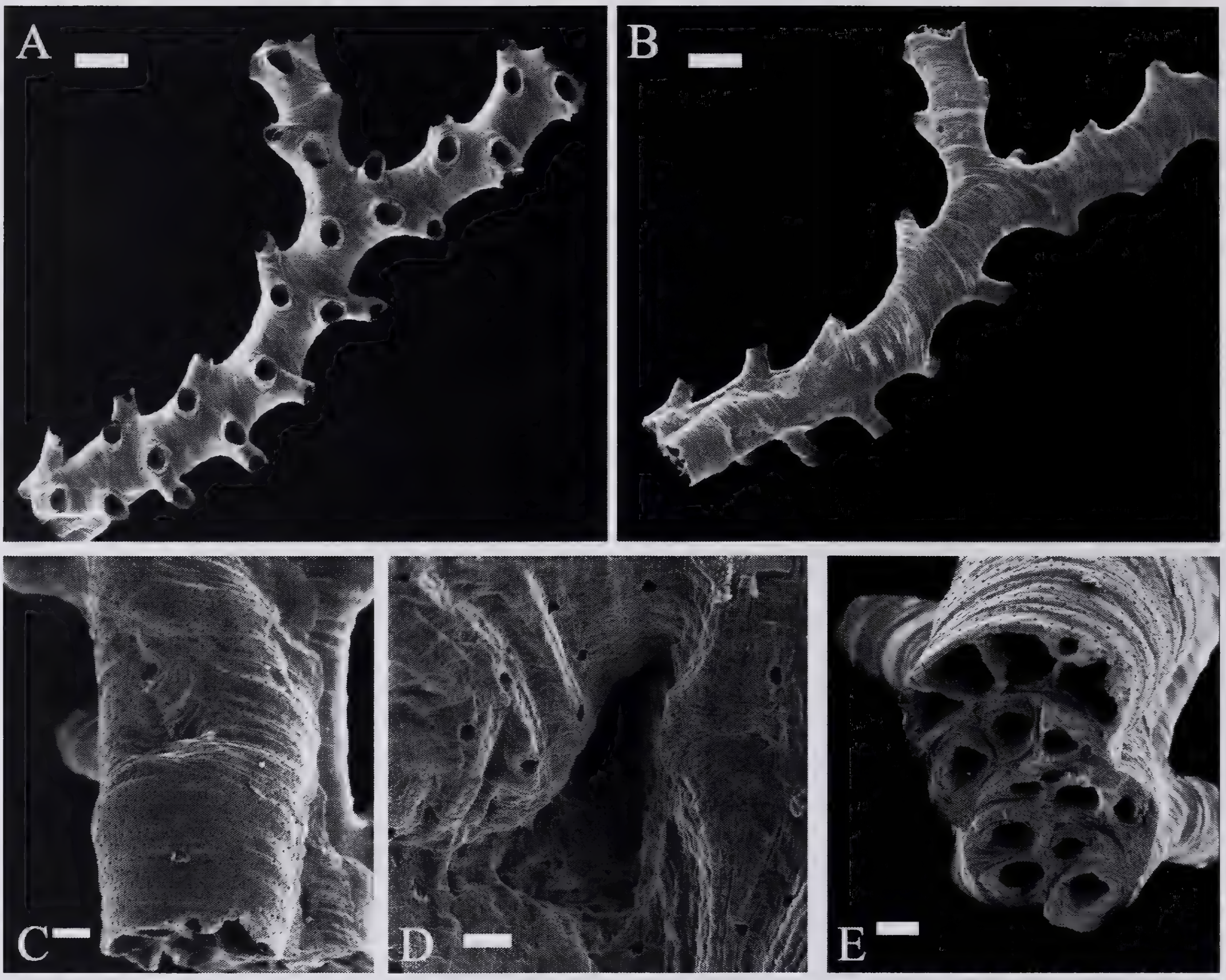

Figure 5. *Tervia* sp. Hassler Box 7. MCZ 100113. A. Frontal view of colony branch. Scale bar = 500 μm. B. Abfrontal surface of same branch. Scale bar = 500 μm. C. Possible gonozooid. Scale bar = 100 μm. D. Opening to possible gonozooid. Scale bar = 20 μm. E. View of broken proximal end of branch. Scale bar = 100 μm.

not possible to identify it further. Its morphology is very similar to the *Patinella* sp. from Smitt's MCZ Florida material, as shown in Figures 348–352 of Winston (2005). But, as with that juvenile colony, there are no gonozooids on which to base a species identification and description.

Specimens Examined. MCZ 100114. Hassler Box 1–2, Barbados, 80 fm. December 1871.

Class Gymnolaemata
Order Cheilostomata
Suborder Neocheilostomina d'Hondt, 1985 (part)
Infraorder Flustrina Smitt, 1868 (part)
Superfamily Calloporoidea Norman, 1903
Family Antroporidae Vigneaux, 1949

Genus *Antropora* Norman, 1903
Antropora typica (Canu & Bassler, 1928)
Figures 7, 8

Membrendoecium strictorostris Canu & Bassler 1928a: 23, pl. 2, fig. 7.
Dacryonella typica Canu & Bassler 1928a: 57, pl. 5. figs. 4–8, pl. 32, figs. 11–12, text-fig. 8a. 1928b: 65, pl. 1, fig. 10.
Antropora typica, Lagaaij, 1963:171, pl.1, fig. 3. Winston 1986: 5, figs. 1–2. Tilbrook, 1998: 37, fig. 3A.

Description. Colony encrusting in one or more layers (Fig. 7A). Zooids with a large irregularly polygonal gymnocyst surrounding a raised subtriangular to pear-shaped cryptocyst with wide striated rows of granular calcification, wide proximally, becoming very narrow at the distal end around the

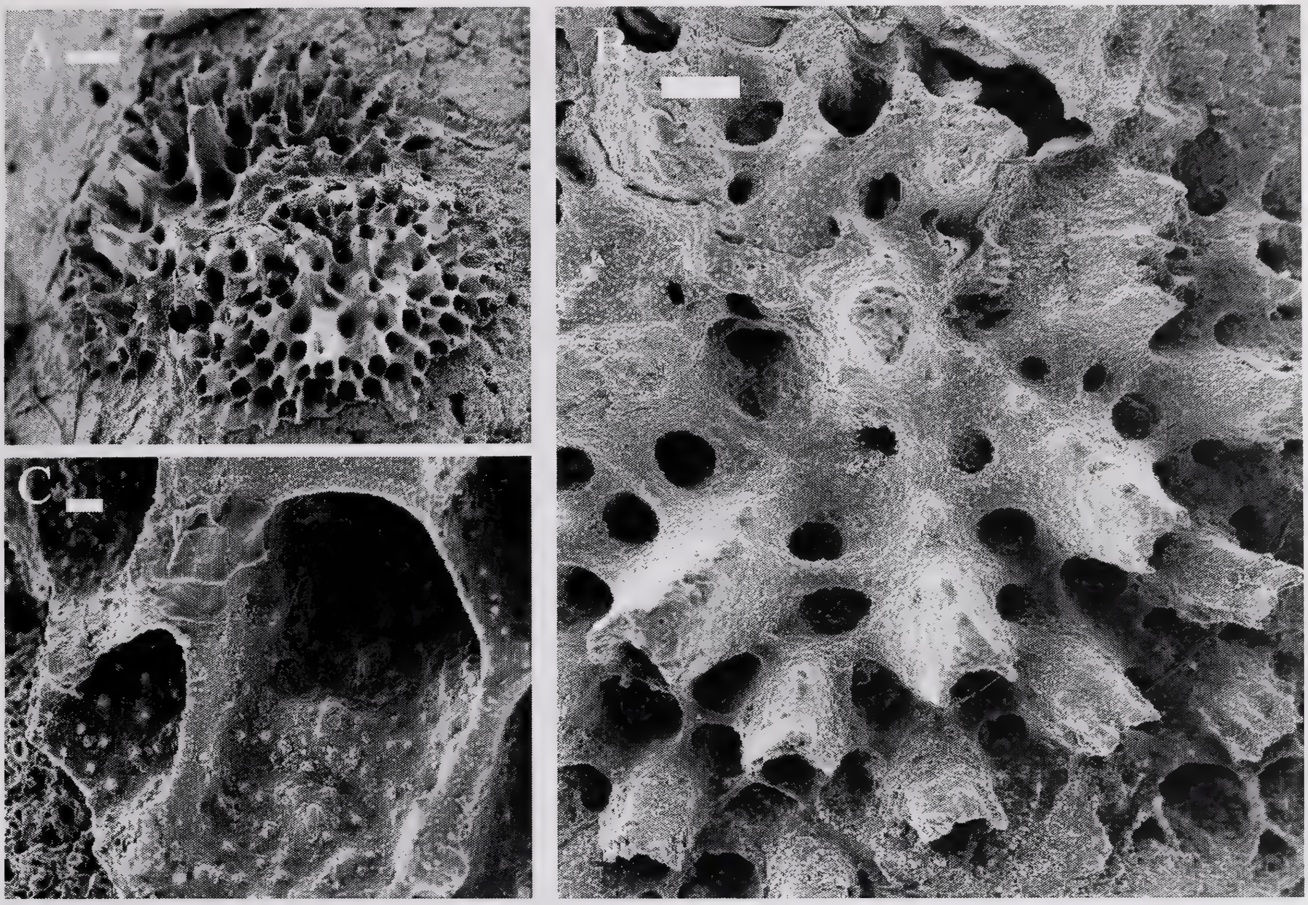

Figure 6. *Patinella* sp. Hassler Box 1. MCZ 100114. A. Entire compound colony. Scale bar = 200 μm. B. Close-up of zooid tubes of smaller subcolony. Scale bar = 100 μm. C. Bumpy surface texture of zooid tubes and peripheral lamina. Scale bar = 10 μm.

operculum (Figs. 7B–D). Small spear-shaped frontal avicularia, oriented in various directions, scattered on frontal gymnocyst walls (Figs. 7C, E). Ovicells endozooidal, marked on the distal rim of the zooid by a thickened bonnet of calcification (Figs. 7C, D).

Measurements

	Range	Mean	*N*
Lz	0.382–0.546	0.460	12
Wz	0.309–0.455	0.370	12
Wo	0.055–0.091	0.077	12
Lov	0.055–0.127	0.100	3
Wov	0.164–0.182	0.176	3
Lav	0.082–0.118	0.100	11
Wav	0.036–0.073	0.054	12
Lop	0.182–0.291	0.218	12
Wop	0.127–0.237	0.181	12

Notes. Photomicrographs of National Museum of Natural History (NMNH) type specimens of *Membrendoecium strictorostris* and *Dacryonella typica* of Canu and Bassler (Fig. 8) clearly indicate their similarity in morphology and size. As Canu and Bassler pointed out in the original description of *M. strictorostris*, "The micrometric measurements are quite variable, ranging from one to twice the size and have only an approximate value. The gymnocyst is frequent but in no wise constant.... There are cases of total regeneration" (Canu and Bassler, 1928a, p. 23). In that case, the species name *strictorostris*, by appearing earliest in the publication, has priority. The second reference to the species, as *D. typica*, appears in their Brazil paper, also published in 1928, but much later in the year. Canu and Bassler (1928a) made *D. typica* the Recent type species of *Dacryonella*. The species above is now considered to fall in the genus *Antropora*, of which the accepted genotype is *Antropora granulifera* Hincks, described from the Las Perlas Islands, off the Pacific coast of Panama, and since recorded from other warm-water localities. However, *Antropora typica* has been accepted over *Antropora strictorostris* by later authors,

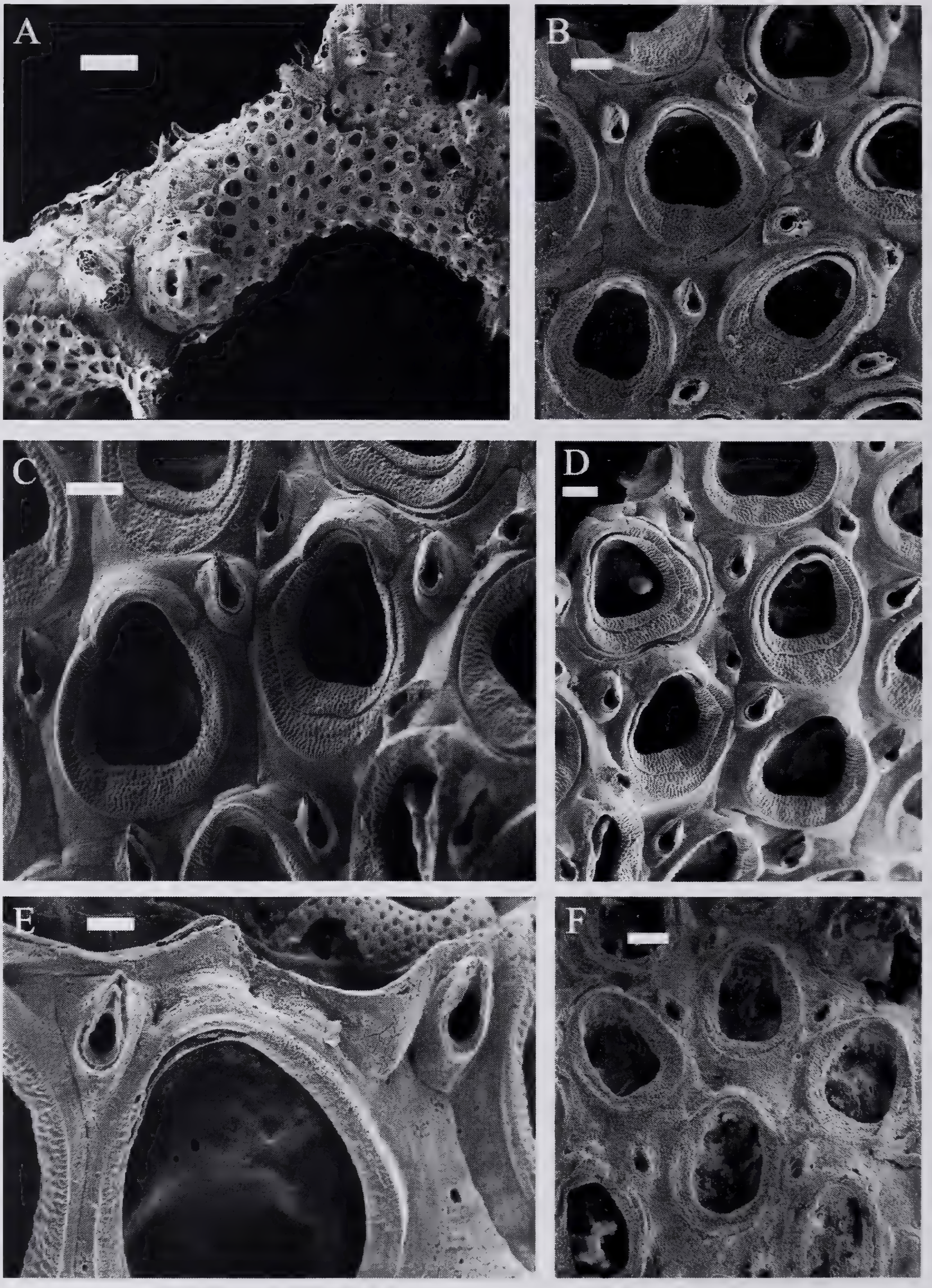

Figure 7. *Antropora typica-1.* (A–E Hassler Box 6. MCZ 10016) A. Entire colony attached to calcarous substratum. Scale bar = 1 mm. B. Group of zooids and avicularia at growing edge of colony. Scale bar = 100 μm. C. Two ovicelled zooids. Scale bar = 100 μm. D. Another group of zooids and avicularia. Scale bar = 100 μm. E. Close-up of two avicularia at growing edge of colony. Scale bar = 50 μm. F. (Hassler Box 2. MCZ 10015) Zooids and avicularia from another colony. Scale bar = 100 μm.

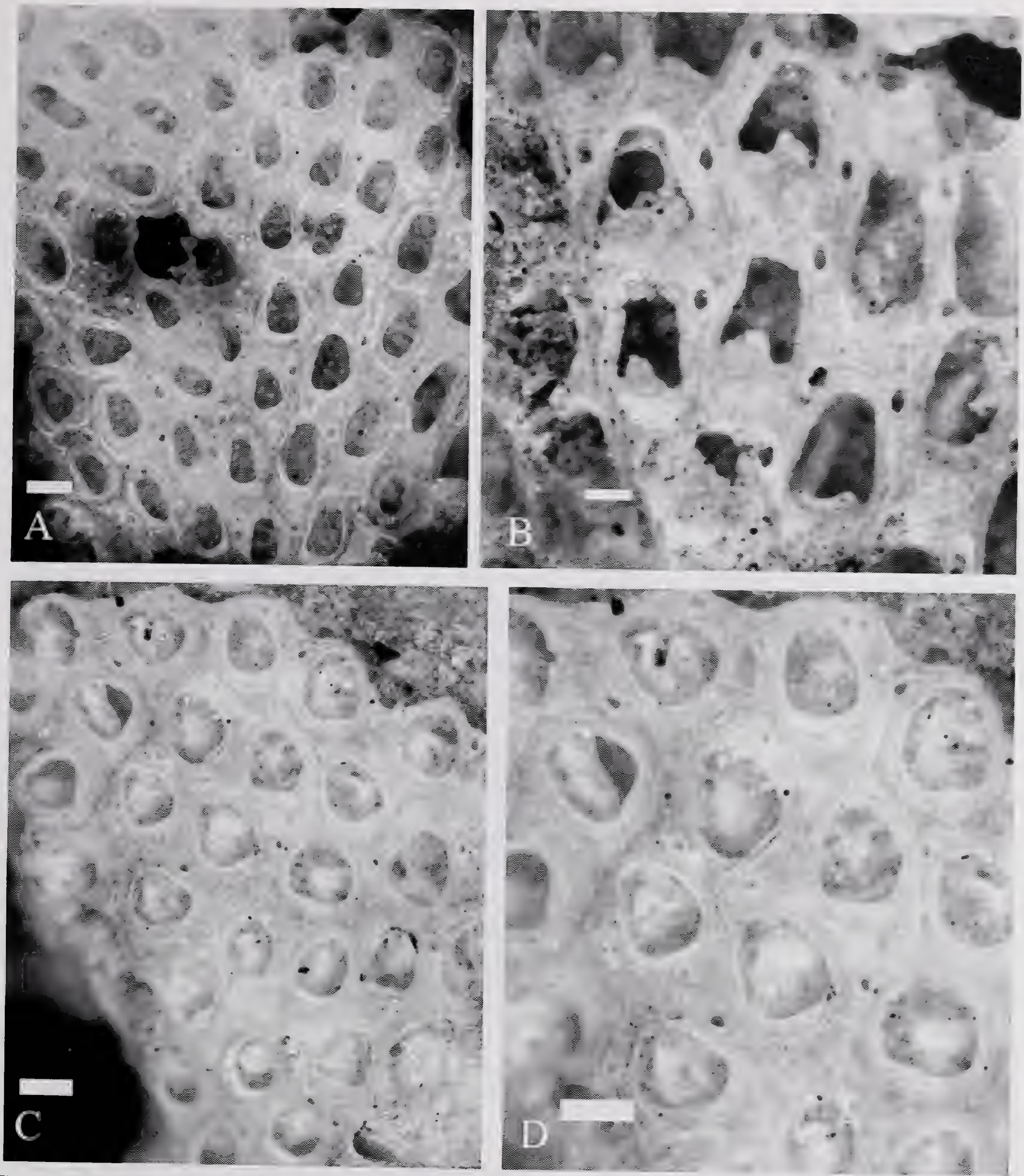

Figure 8. *Antropora typica-2.* Light micrographs of type material of Canu and Bassler. A. *Dacryonella typica* USNM 7484 cotype 1. Scale bar = 200 µm. B. *Dacryonella typica.* Magnified view of zooids and avicularia. USNM 7484 cotype 2. Scale bar = 100 µm. C. *Membrendoecium strictorostris.* Type. USNM no. 7552. Scale bar = 200 µm. D. *Membrendoecium strictorostris.* View of several zooids at higher magnification, same specimen. Scale bar = 200 µm.

not withstanding priority, apparently on the basis of the recommendation of Lagaaij (1963, p. 171), "It would seem appropriate to retain the specific name of the form figured in most detail, which is *typica.*" He based his decision also on the fact that type material of both *M. strictorostris* and *D. typica* were collected at the same *Albatross* station, although *D. typica* specimens are listed from two other localities as well.

Distribution. Western Atlantic: Florida to Brazil, Caribbean, Gulf of Mexico.

Specimens Examined. MCZ 100115. Hassler Box 2, Barbados, 80 fm. December 1871. MCZ 100116. Hassler Box 6, Barbados, 100 fm. December 1871. *Dacryonella typica* USNM 7484 cotype-1 and cotype-2. *Membrendoecium strictorostris*. Type. USNM no. 7552. Both from *Albatross* Station D. 2319, north of Cuba, 23°10′37″N, 82°20′06″W; 143 fm, gray coral.

Superfamily Buguloidea Gray, 1848
Family Candidae d'Orbigny, 1851
Genus *Caberea* Lamouroux, 1816
Caberea hassleri new species
Figures 9, 10

Holotype. MCZ 100117. Hassler Box 5, Barbados, 80 fm. December 1871.

Etymology. Named for the vessel used in the expedition.

Description. Colony tuftlike, erect, and biserially branching (Figs. 9A, B). Frontal surface of branches with two alternating rows of zooids. Color of dried specimen whitish-tan, attached to substratum by rhizoids from the proximal face (Fig. 9C). Zooids short, with an oval frontal membrane that covers most of frontal surface, surrounded by gymnocyst (Fig. 9B). Two or three stout hollow spines with cone-shaped tips on outer distal angle, one spine on inner angle (Fig. 10C). An additional one or two spines visible on zooids at growing tip before development of frontal avicularia covers or replaces them. Only the two proximal spines are visible on ovicelled zooids. Scutum a thick-stemmed and irregular-shaped paddle that covers most of the frontal membrane (Fig. 9E). Orifice semicircular. Raised bluntly triangular avicularia occur on the inner distal margin, mostly small but somewhat variable in size, and sometimes replaced by a giant avicularium with a serrate rostrum (Fig. 9F). Small triangular lateral avicularia also occur. Vibracula long and distally serrated on one side (Figs. 10 A–C). Vibracular chambers are placed on the abfrontal surface, almost covered by attachment radicles, but projecting laterally so that the setal grooves are visible in frontal view. Ovicells subglobular, rounded on their outer edge, pointed distally and on their inner edge, showing inner and outer layers, and a proximal semicircular opening (Figs. 9, 10).

Diagnosis. *Caberea* with large scutum, but with scutum enclosing frontal membrane less tightly than in *Caberea boryi*, the most similar species. Differs from *C. boryi* also in ovicell morphology. The ovicell of *Caberea hassleri* is asymmetrical in shape and flattened, with no foramen, whereas that of *C. boryi* is globular with a central foramen.

Measurements

	Range	Mean	*N*
Lz	0.328–0.437	0.379	6
Wz	0.200–0.255	0.228	6
Lo	0.055–0.073	0.065	6
Wo	0.082–0.091	0.089	6
Lov	0.109–0.164	0.140	6
Wov	0.182–0.255	0.221	6
Lav	0.073–0.109	0.088	6
Wav	0.036–0.055	0.046	6
Lop	0.127–0.182	0.158	6
Wop	0.100–0.127	0.115	6
Lo + Lop	0.191–0.255	0.223	6

Notes. *Caberea boryi* has been reported from many widespread localities (Hayward and Ryland, 1998). In the western Atlantic it has been recorded from Cape Hatteras to Florida and the Gulf of Mexico (Lagaaij, 1963; Maturo, 1968), as well as from Brazil. This is the first record of a second *Caberea* species in this region.

Distribution. Barbados.

Specimens Examined. MCZ 100117. Hassler Box 5, Barbados, 80 fm. December 1871.

Superfamily Microporoidea Gray, 1848
Family Steginoporellidae Hincks, 1884
Genus *Steginoporella* Smitt, 1873
Steginoporella magnilabris (Busk, 1854)
Figure 11

Membranipora magnilabris Busk, 1852: vi (explanation of pl. LXV), pl. LXV, fig. 4; 1854: 62 (part), 113.
Steginoporella elegans Smitt, 1873: 15, pl. IV, figs. 96–101; Verrill, 1900: 594. NOT *Eschara elegans* (Milne-Edwards, 1836: 337, pl. 12, fig. 13).
Steganoporella magnilabris Osburn, 1914: 196; 1940: 375, 1947: 18; Canu & Bassler, 1923: 63, pl. 14, figs. 12,

Figure 9. *Caberea hassleri-1*. Hassler Box 5. MCZ 100117. A. Low magnification view of large branch fragment to show branch form and branching pattern. Scale bar = 500 μm. B. Two branches showing morphology of zooids, scuta, and ovicells. Scale bar = 200 μm. C. Abfrontal surface of branch. Scale bar = 250 μm. D. Portion of a branch showing small avicularia and spines. Scale bar = 100 μm. E. Close-up of growing tip of branch. Scale bar = 20 μm. F. Giant avicularium on branch. Scale bar = 100 μm.

13; 1928b: 64, pl. 7, figs. 8–10, pl. 32, fig. 6; Marcus, 1955: 284, Estampa 2, fig. 25; Cook, 1964a: 53, pl. 1, fig. 4, fig. 2; 1968a: 153; 1985: Cook, 1985: 108, pl. 12D; Long & Rucker, 1970: 19, figs. 2, 6; Powell, 1971: 769.
Steginoporella magnilabris Shier, 1964: 618; Pouyet and David, 1979: 784, text-fig. 2, pl. 1, figs. 6,7; Winston, 1984: 10, fig.18.

Description. Colonies encrusting on flat surfaces, or sometimes spreading into tubular to leafy expansions. Colony color pearly pinkish-red to red to red-brown. To the unaided eye the colony has a snakeskin texture due to the large zooids outlined by whitish lateral walls. Zooids dimorphic, mostly of the smaller A-zooid type, interspersed with larger B-zooids. Both forms subrectangular in shape, with raised lateral margins. In the distal portion of the zooids large chitinous opercula are seated upon the horseshoe-shaped shelf formed by curved, sharp-edged distal rim that reaches the curved proximal condyles on

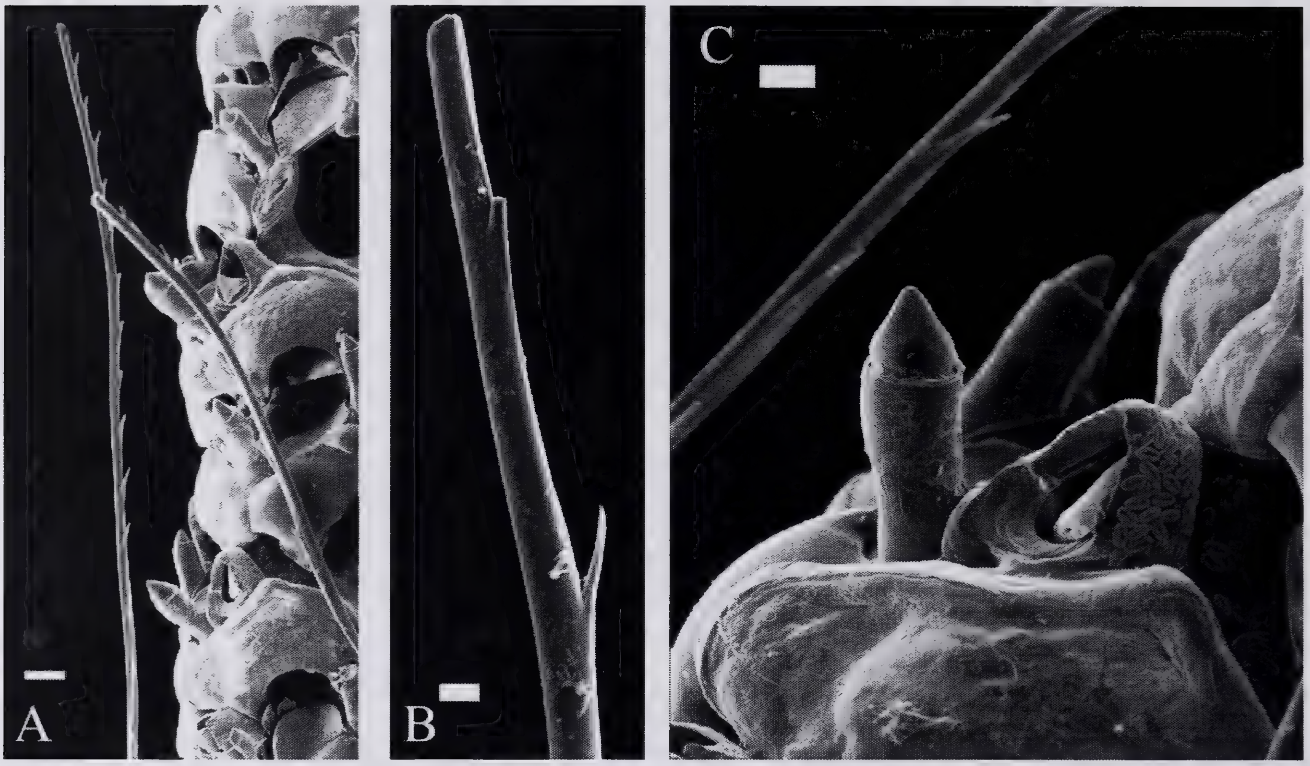

Figure 10. *Caberea hassleri-2*. Hassler Box 5. MCZ 100117. A. Vibraculum with wide-spaced spines, rather than closely spaced serrate ones as in *Caberea boryi*. Scale bar = 50 μm. B. More highly magnified view of spine. Scale bar = 10 μm. C. Close-up of pointed spines and small avicularium. Scale bar = 20 μm.

which they hinge. In the proximal half of the zooid the frontal membrane is underlain by a porous cryptocyst that dips sharply downward from the proximal margin, then rises again to form a sharply inclined tonguelike calcified polypide tube that is separated from the lateral walls by deep notches. In A-zooids the semicircular operculum is reinforced by an inverted U-shaped sclerite and bordered by rakelike chitinous teeth. The larger opercula of B-zooids have an inverted Y-shaped sclerite, bigger marginal teeth, and usually show a crescent-shaped expansion of porous cryptocyst just below the distal rim. No avicularia or ovicells. Embryos brooded in zooids.

Measurements

	Range	Mean	*N*
Lz (A)	0.728–1.037	0.901	6
Wz (A)	0.528–0.728	0.628	6
Lop (A)	0.364–0.619	0.443	6
Wop (A)	0.528–0.728	0.628	6
Lz (B)	1.147–1.274	1.210	2
Wz (B)	0.728–0.746	0.737	2

Notes. B-zooids have been considered as precursors to vicarious avicularia. Unlike avicularia, B-zooids have functional polypides that expand to feed along with A-zooids. However, the opercula of B-zooids often open before those of A zooids, their behavior thus more like the mandibles of avicularia. They also appear more responsive than A-zooids to a chemical stimulus, opening to crab juice or amino acid seawater solutions (Winston, 2005).

Distribution. Western Atlantic: Georgia to Brazil, Gulf of Mexico, Caribbean.

Specimens Examined. MCZ 100118. Hassler Box 12, Barbados, 100 fm. December 1871.

Steginoporella connexa Harmer, 1900
Figure 12

Steganoporella connexa Harmer, 1900: 254, pl. 12, fig. 6; pl. 13, fig. 18.
Steginoporella connexa Pouyet and David, 1979: 773, text-fig. 2.
Steginoporella species, Winston, 1984: 10, Figs. 19, 20.

Description. Colony encrusting, sometimes expanding into tubular or platy forms,

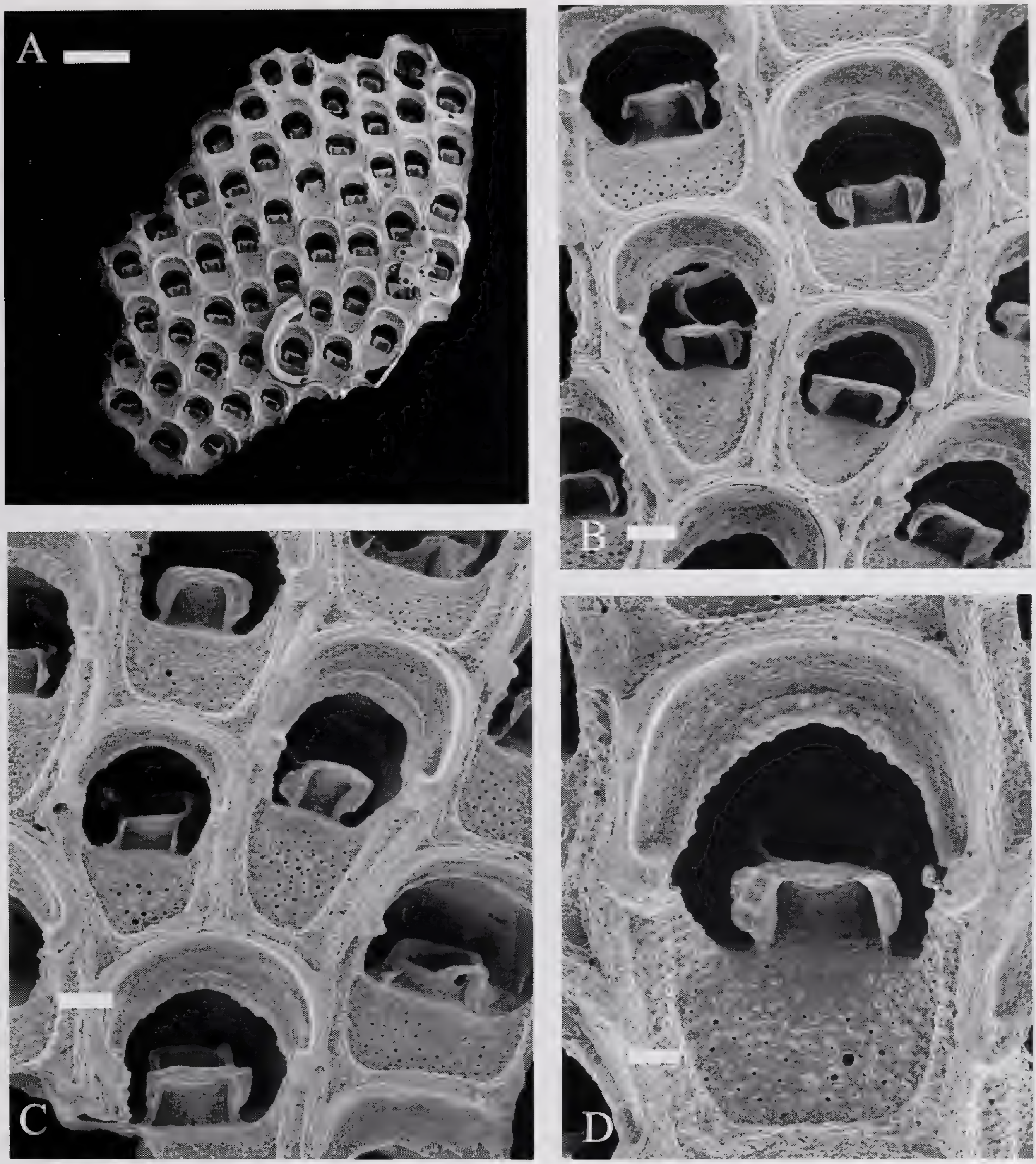

Figure 11. *Steginoporella magnilabris*. Hassler Box 12. MCZ 100118. A. Colony fragment (skeletal). Scale bar = 1 mm. B. Zooids of differing sizes. Scale bar = 200 μm. C. A- and B-zooids. Scale bar = 200 μm. D. Close-up of zooid showing polypide tube. Scale bar = 100 μm.

red to brownish in color when living, with a snakeskin texture similar to that of *S. magnilabris*. Zooids curved distally and rectangular proximally, with a large semicircular orifice, with a heavily calcified rim (Figs. 12A, B). Zooids dimorphic, smaller A-zooids and larger B-zooids. A-zooids have a proximally depressed porous cryptocyst that is perforated by two pairs of opesiules just below the raised proximal rim of the orifice. In A-zooids the orifice takes up the distal third of the zooid (Fig. 12C). In the larger B-zooids the operculum covers about half the zooid, the opesiules may converge as slits, and the narrow distal cryptocyst may be enlarged to support the larger operculum.

The chitinous opercula of both zooid forms are strongly reinforced and rimmed with sharp pointed teeth (Fig. 12 D). No avicularia. No ovicells. Embryos brooded internally.

Measurements

	Range	Mean	*N*
Lz	0.928–1.365	1.139	12
Wz	0.601–0.910	0.748	12
Lo	0.309–0.382	0.349	6
Wo	0.455–0.546	0.494	6
Lop	0.364–0.419	0.394	12
Wop	0.455–0.601	0.527	12

Notes. Recent species of *Steginoporella* are found in tropical marine environments, often associated with coral reefs. Paleontologists consider them a good paleoecological indicator for similar environments in the past (Pouyet and David, 1979).

Distribution. Caribbean, Brazil.

Specimens Examined. MCZ 100119. Hassler Box 2, Barbados, 80 fm. December 1871.

Superfamily Cellarioidea Lamouroux, 1821
Family Cellariidae Lamouroux, 1821
Genus *Cellaria* Ellis and Solander, 1786
Cellaria louisorum new species
Figure 13

Holotype. *Cellaria louisorum* MCZ 100120. Hassler Box 3, Barbados, 80 fm. December 1871.

Etymology. By adding the Latin masculine genitive plural *-orum* to the name Louis.

Named in honor of the two Louis, Louis Agassiz and Louis F. Pourtalès, who collected these specimens on their last expedition together.

Description. Colony consisting of erect, cylindrical, jointed branches (Fig. 13A), developing from a rooted base. Zooids arranged in alternating rows along and around the branches. Zooids broadly hexagonal, distal rims rounded (Figs. 13B, C). Gymnocyst lacking, frontal membranes underlain by a sloping depressed cryptocyst, its calcification pustulose. Opesia reduced to the area just around the operculum. Orifice broadly crescentic, its distal rim beaded, its proximal rim concave, with stout, rounded condyles at each end (Figs. 13C, E). Avicularia vicarious, their hexagonal zooids about equal in size to autozooids, with a round-tipped spear-shaped mandible supported by proximally projecting condyles (Fig. 13D). Ovicelled zooids also similar in size and shape to nonfertile zooids. Ovicells immersed, detectable only by a rounded foramen in the distal cryptocyst, and in some cases (Fig. 13F) by a wider orifice with a concave, rather than convex, proximal rim.

Diagnosis. Differs from the other known Caribbean species of *Cellaria* in the shape of its avicularia, which, though spear-shaped, are broader than those of *Cellaria bassleri*, and in contrast to the semicircular avicularia of *Cellaria mandibulata*. *Cellaria louisorum* also differs from *C. bassleri* in having wider branches, broadly hexagonal vs. rhombic-elliptical zooids, and a round rather than slit-shaped ovicell foramen.

Measurements

	Range	Mean	*N*
Lz	0.373–0.455	0.402	6
Wz	0.218–0.273	0.243	6
Lo1	0.055–0.073	0.065	6
Wo1	0.091–0.127	0.108	6
Lav	0.382–0.455	0.411	5
Wav	0.182–0.218	0.204	5
Lo2	0.073–0.082	0.075	5
Wo2	0.100–0.146	0.118	5
Lov2	0.364–0.400	0.379	5
Wov2	0.237–0.273	0.258	5

Notes. Only two living species of *Cellaria* have previously been recorded from the greater Caribbean–Gulf of Mexico region, *C. bassleri* Hastings, 1947, and *C. mandibulata* Hincks (Osburn, 1947). *Cellaria bassleri* was originally described from the Tortugas by Smitt, who identified it wrongly as *Cellaria tenuirostris* from Bass Strait (Winston, 2005). Branches and zooids of *C. bassleri* are narrower, and zooids rhomboidal to elliptical in shape and narrower relative to their length than those of *C. louisorum*. The avicularia of *C. louisorum* are similarly stouter in shape, although both species have avicularia similar in size to autozooids. Ovicells of *C. bassleri* are marked by a slitlike rather than circular foramen. The other species described from the area, *C. mandibulata*, from Aruba (Osburn, 1947), with no illustration, is a

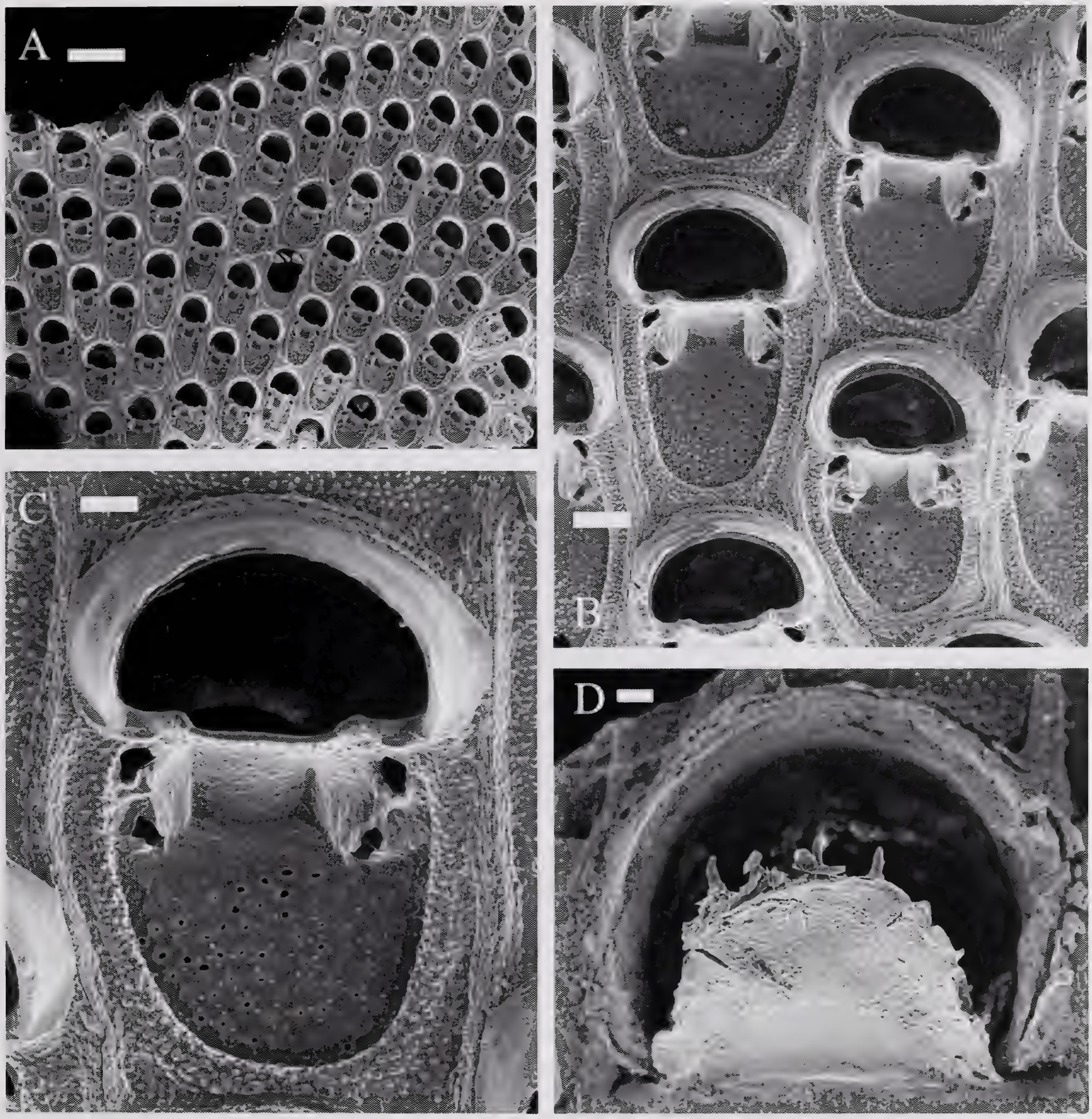

Figure 12. *Steginoporella connexa*. Hassler Box 1-2. MCZ 100119. A. Portion of colony. Scale bar = 1 mm. B. Group of skeletal (bleached) A-zooids. Scale bar = 200 μm. C. Close-up of one A-zooid. Scale bar = 100 μm. D. Unbleached area, showing an A-zooid operculum. Scale bar = 50 μm.

species with avicularia with semicircular rather than spear-shaped mandibles.

Distribution. Barbados.

Specimens Examined. MCZ 100120. Hassler Box 3, Barbados, 80 fm. December 1871.

Infraorder Ascophora Levinsen, 1909
"Grade" Acanthostega Levinsen, 1902
Superfamily Cribrilinoidea Hincks, 1879

Family Cribrilinidae Hincks, 1879
Genus *Puellina* Jullien, 1886
Puellina smitti Winston, 2005
Figure 14

Cribrilina radiata Smitt, 1873: 22. In part. NOT *Eschara radiata* Moll, 1803: 63, pl. 4, Fig. 17a–i.
Cribrilaria flabellifera Banta & Carson, 1977: 392, fig. 4.4; Winston, 1984: 13, figs. 25–27. Not *Cribrilina radiata* var. *flabellifera* Kirkpatrick, 1888: 75. pl.10, fig. 4.
Puellina smitti Winston, 2005: 34, Figs. 89–93.

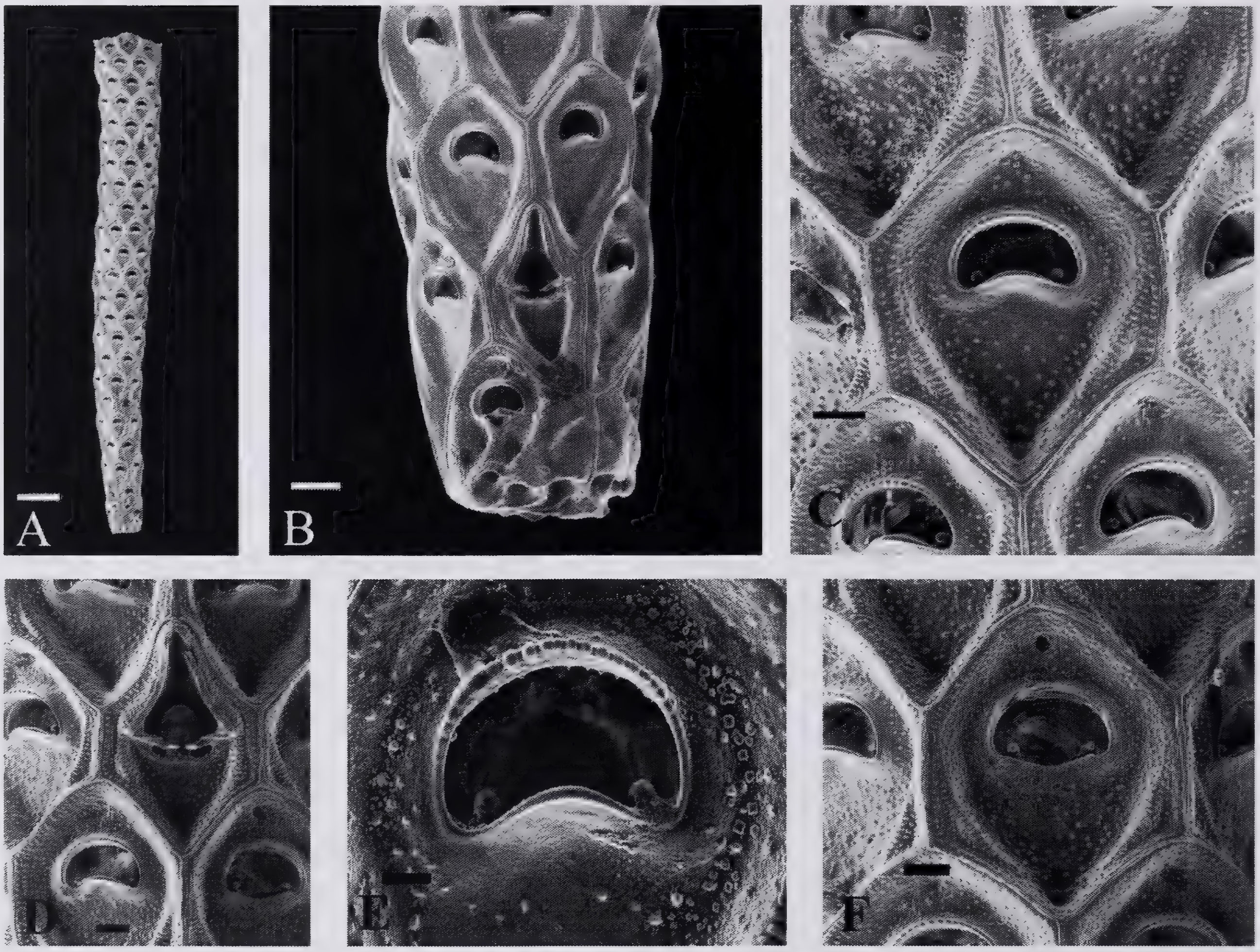

Figure 13. *Cellaria louisorum.* Hassler Box 3. MCZ 100120. A. One branch internode. Scale bar = 500 μm. B. Close-up of proximal end of internode showing avicularium and zooids. Scale bar = 100 μm. C. An autozooid. Scale bar = 100 μm. D. Close-up of an avicularium. Scale bar = 50 μm. E. Close-up of orifice, showing beaded distal rim, curved proximal rim, and rounded condyles. Scale bar = 20 μm. F. Fertile zooid, showing ovicell foramen and wider orifice. Scale bar = 50 μm.

Description. Colony encrusting and small in size, often heavily fouled or partly overgrown (Fig. 14A). Zooids small, more or less oval in shape. Frontal walls composed of five to eight pairs of well-defined, rounded, radiating costae, separated by evenly spaced pores. The first set of costae is sometimes thicker than the following costae and may show a bifid median umbo (Fig. 14C). Orifice semicircular with six hollow spines surrounding its distal and lateral rim (Fig. 14D). Avicularia with oval zooids covered by smooth calcification, a flaring calcified rostrum, and a subtriangular, paddle-shaped mandible, are found between zooids, especially at growing edges of colonies. Ovicells imperforate, helmet-shaped, with a central-frontal thickening.

Measurements

	Range	Mean	*N*
Lz	0.328–0.437	0.379	12
Wz	0.218–0.328	0.268	12
Lo	0.046–0.073	0.057	11
Wo	0.055–0.091	0.077	12
Lov	0.164–0.182	0.170	3
Wov	0.146–0.146	0.146	3
Lav	0.200–0.273	0.228	12
Wav	0.109–0.200	0.135	12

Notes. Despite abrasion and fouling of the fragmentary Hassler Barbados specimens, their distinguishing specific characters are clear. So far six *Puellina* species have been described from the tropical Western Atlantic, all distinguishable by a combination of size (zooid length) and other characters. *Puellina smitti* is the only one of them with flabellate avicularia. The only other species with six oral spines, *Puellina parva* Winston and Håkans-

son, 1986, is very small (mean zooid length = 0.232 mm) and has no avicularia. The other species lacking avicularia, *Puellina capronensis* Winston, 2005, has a mean zooid length of 0.316 mm, five oral spines, and a pronounced, raised first pair of costae. The largest species, *Puellina saginata* Winston, 2005, is 0.73 mm in length, and has an expanded gymnocystal area, no suboral lacuna, pointed avicularia, and five pairs of spines, whereas the other species with five oral spines, *Puellina testudinea* Winston, 2005, is considerably smaller (mean zooid length, 0.500 mm) and has a suboral lacuna. Additional *Puellina* species are likely to be found in the tropical western Atlantic region. Despite their inconspicuous and probably ephemeral nature, they are often common on calcareous substrata and seem to be pioneers of newly available substrata, from dead shell or coral to fouling panels.

Distribution. Florida Atlantic coast, Caribbean.

Specimens Examined. MCZ 100121. Hassler Box 2 (with *Metroperiella*), Barbados, 80 fm. December 1871. MCZ 100122. Hassler Box 6 (with *Antropora*), Barbados, 100 fm. December 1871.

"Grade" Umbonulomorpha Gordon, 1989
Superfamily Lepralielloidea Vigneaux, 1949
Family Romancheinidae Jullien, 1888
Genus *Exochella* Jullien, 1888
Exochella tropica new species
Figure 15

Exochella longirostris, Lagaaij, 1963:194, pl. 5, fig. 5. [USNM648040]

Holotype. MCZ 100123. *Exochella tropica*. Hassler Box 1-2, Barbados, 80 fm. December 1871.

Etymology. Named for its preference for warm seas in contrast to the cold water preference of other members of the genus.

Description. Colony white, encrusting, rough-textured in appearance due to its heavily calcified ribbed zooids and projecting avicularia (Fig. 15A). Zooids oval to rhombic in shape. Frontal wall calcification imperforate except for large marginal pores located between lateral ribs of calcification that extend and become flattened toward the midpoint of the convex zooids (Figs. 15C and D). Primary orifice hoof-shaped, rounded distally, and shallowly convex proximally (Fig. 15E). Four hollow spines occur at the distal end of the orifice (Figs. 15E and F). As zooids age, the central proximal margin of the orifice is obscured by a projecting bifid lyrula (Fig. 15F) that develops into a large proximal mucro. Lateral processes developing from the sides of the orifice curve and may join, forming two rings on each side of the central projection. As zooids undergo secondary calcification, a thick tubercle may also develop below the peristome. Single or paired avicularia are located in the proximal third of zooid lateral walls, oriented laterally to slightly distolaterally. They have crossbars and narrowly triangular rostra, raised at an angle from the downsloping zooid margins. No ovicells were present on the material collected.

Diagnosis. *Exochella* species having four oral spines (visible only early in astogeny, Figs. 15E, F), a hoof-shaped primary orifice, strongly marked marginal pores and ribs, and single or paired avicularia placed below the midpoint on lateral walls and oriented laterally to slightly distolaterally. *Exochella tropica* differs from *E. longirostris* Jullien (1888) in the shape of the primary orifice, the number of oral spines (three for *E. longirostris*), and the position of the avicularia (at the midpoint of the lateral wall and laterally oriented), and by its ribbed rather than granular calcification.

	Measurements		
	Range	Mean	*N*
Lz	0.455–0.546	0.494	6
Wz	0.218–0.309	0.261	6
Lo	0.064–0.082	0.073	6
Wo	0.109–0.137	0.126	6
Lav	0.127–0.218	0.170	6
Wav	0.055–0.109	0.076	6
Avic distance from zooid distal end	0.255–0.309	0.273	6

Notes. According to Hayward (1995), *E. longirostris* is a magellanic species with a range extending from southern Chile to the Falkland Islands. The genus *Exochella* itself

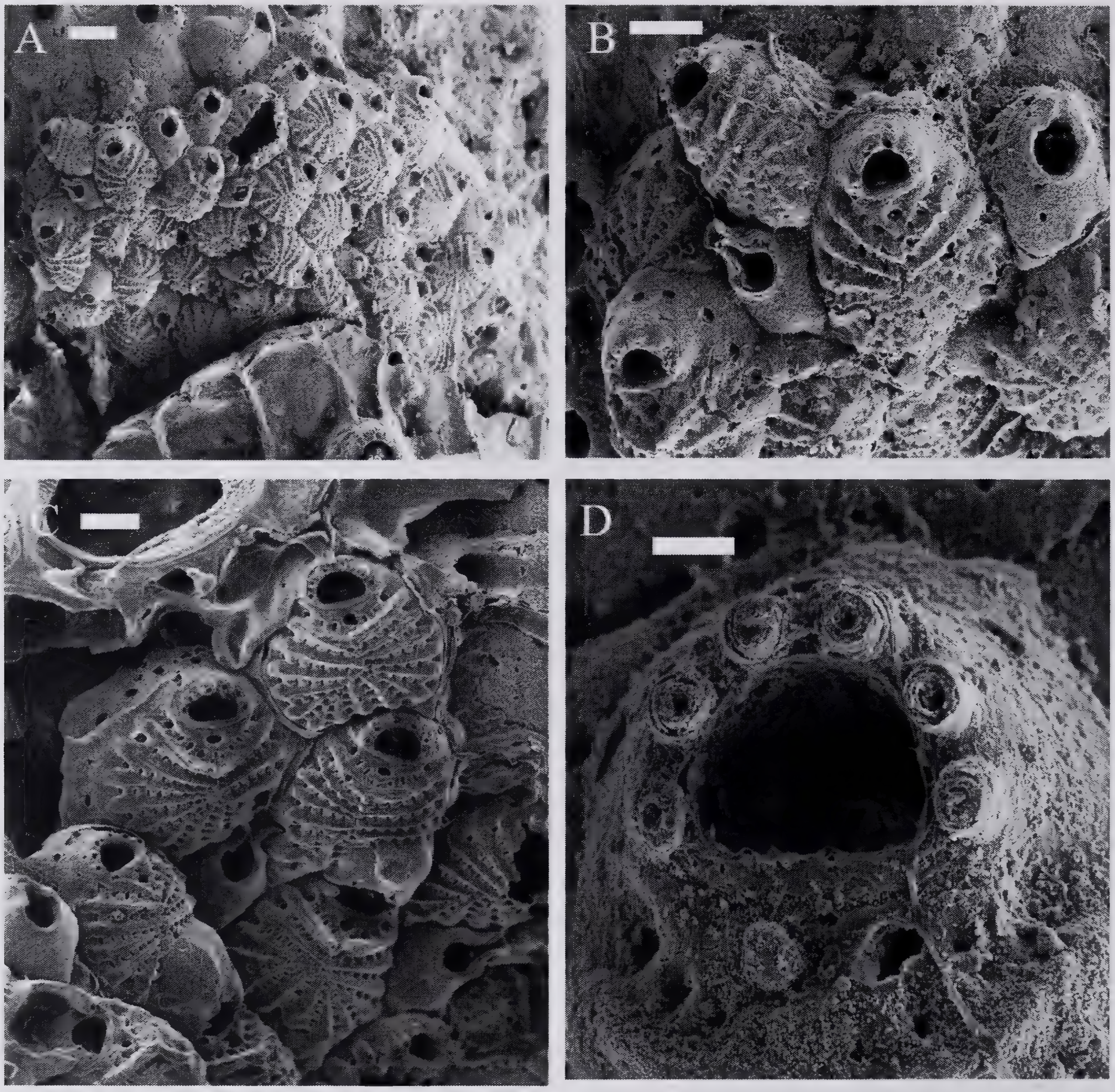

Figure 14. *Puellina smitti*. Hassler Box 2. MCZ100121. A. Entire colony. Scale bar = 200 μm. B. Close-up of zooids at growing edge interspersed with oval avicularian zooids with flared rostra. Scale bar = 100 μm. C. Group of zooids including one ovicelled zooid. Scale bar = 100 μm. D. Close-up of a zooid orifice, showing six spines. Scale bar = 20 μm.

has a largely Southern Hemisphere cold-temperate distribution. Records from more tropical areas possibly refer to one or more undescribed species.

Distribution. Gulf of Mexico. Barbados.

Specimens Examined. MCZ 100123. *Exochella tropica.* Hassler Box 1-2, Barbados, 80 fm. December 1871.

"Grade" Lepraliomorpha Gordon, 1989
Superfamily Smittinoidea Levinsen, 1909
Family Smittinidae Levinsen, 1909

Genus *Smittoidea* Osburn, 1952
Smittoidea reginae new species
Figure 16

Holotype. MCZ 100124. Hassler Box 15, Barbados, 100 fm. December 1871.

Etymology. Species name from Latin: *regina* = queen, *reginae* = of the queen, for its royal necklace of avicularia.

Description. Colony encrusting (Fig. 16A). Zooids large, rectangular to polygonal in shape. Frontal wall covered by granular

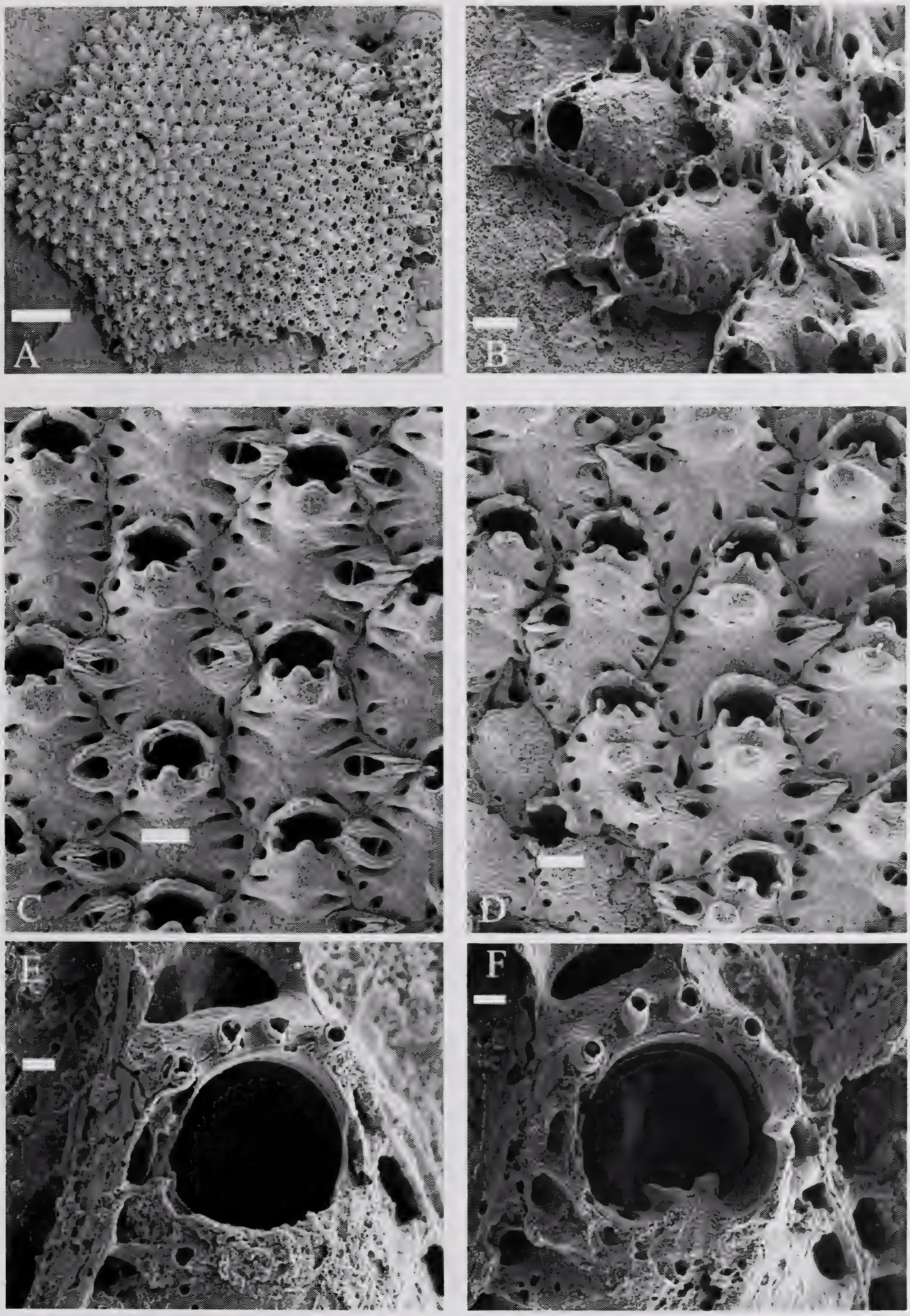

Figure 15. *Exochella tropica*. Hassler Box 1-2. MCZ 100123. A. Entire encrusting colony. Scale bar = 1 mm. B. Close-up of growing edge of colony. Scale bar = 100 μm. C. Group of zooids. Note position of avicularia. Scale bar = 100 μm. D. Another group of zooids with strong development of central umbo. Scale bar = 100 μm. E. Developing hoof-shaped primary orifice showing four orificial spines. Scale bar = 20 μm. F. Another orifice on which development of bifid lyrula has begun. Scale bar = 20 μm.

calcification and rimmed by large marginal pores (Figs. 16B, C). Primary orifice with a high convex lyrula and down-curving condyles. Zooids at growing edge with two to three oral spines (Figs. 16E and F). As zooids mature they develop a low rough-textured peristome. A centered, suboral, oval avicularium plus two distolaterally directed oval avicularia on the edge of the peristome create a jeweled necklace effect (Figs. 16B, C). Some zooids have one or two additional avicularia near the proximal end of the frontal wall. Ovicells round, somewhat immersed, frontal surface with small pores and a rough-textured proximal rim (Fig. 16D).

Measurements

	Range	Mean	*N*
Lz	0.473–0.910	0.664	6
Wz	0.364–0.528	0.455	6
Lo	0.118–0.146	0.127	6
Wo	0.091–0.118	0.105	6
Lov	0.182–0.218	0.204	5
Wov	0.273–0.309	0.288	5

Diagnosis. *Smittoidea* with two to three oral spines and peristome bearing three oval avicularia, two lateral and one proximal.

Notes. Some zooids of this colony have a partial second row of pores, perhaps as a result of repair after damage to the colony.

Distribution. Barbados.

Specimens Examined. MCZ 100124. Hassler Box 15, Barbados, 100 fm. December 1871.

Genus *Parasmittina* Osburn, 1952
Parasmittina barbadensis new species
Figures 17, 18

Holotype. MCZ 100125. Hassler Box 12, Barbados, 100 fm. December 1871.

Etymology. Named for the island of Barbados where the species was collected.

Description. Colony encrusting in one or more layers (Fig. 17A). Zooids oval to polygonal in shape with a beaded granular frontal wall, having only a few tiny pores, but with a row of larger, rounded to irregularly shaped marginal pores (Figs. 17A–C). Primary orifice higher than wide (Figs. 17D, E), with a narrow central lyrula and condyles rimmed by overlapping plates, denticulate in appearance at high magnification (Figs. 18C, D). The distal rim of the orifice is beaded (Fig. 18B). Zooids develop a peristome raised laterally to partially cover the lateral rims of the primary orifice. There are one or two oral spines above the distal rim of the orifice (Figs. 17D, E, 18B). Avicularia are varied in size and shape: oval to elongate oval, and triangular. No giant avicularia were found. Oval avicularia with varying orientations occur adjacent to the peristome or on the proximal region of the frontal wall. Broadly triangular avicularia oriented distolaterally to distally are also found adjacent to the peristome. Ovicells transversely oval, with scattered round pores around an imperforate central area.

Measurements

	Range	Mean	*N*
Lz	0.655–0.892	0.804	6
Wz	0.400–0.637	0.510	6
Lo	0.127–0.155	0.141	6
Wo	0.127–0.146	0.133	6
Lov	0.237–0.291	0.267	6
Wov	0.291–0.382	0.340	6
Lav	0.127–0.146	0.133	6
Wav	0.055–0.091	0.074	6
Lav2	0.127–0.328	0.176	6
Wav2	0.055–0.200	0.086	6

Diagnosis. Orifice ultrastructure is distinctive; few *Parasmittina* combine a beaded rim and denticulate condyles. *Parasmittina inalienata* Tilbrook, 2006 from the Pacific Solomon Islands is similar in terms of shape of oval avicularia and in having an orifice with narrow condyles, laterally raised peristome, and two oral spines, but that species has only one type of avicularium and lacks the beaded distal rim.

Notes. This species does not correspond with any previously described from the Caribbean–western Atlantic region.

Distribution. Barbados.

Specimens Examined. MCZ 100125. Hassler Box 12, Barbados, 100 fm. December 1871.

Family Bitectiporidae MacGillivray, 1895
Genus *Parkermavella* Gordon & d'Hondt, 1997
Parkermavella salebrosa new species
Figure 19

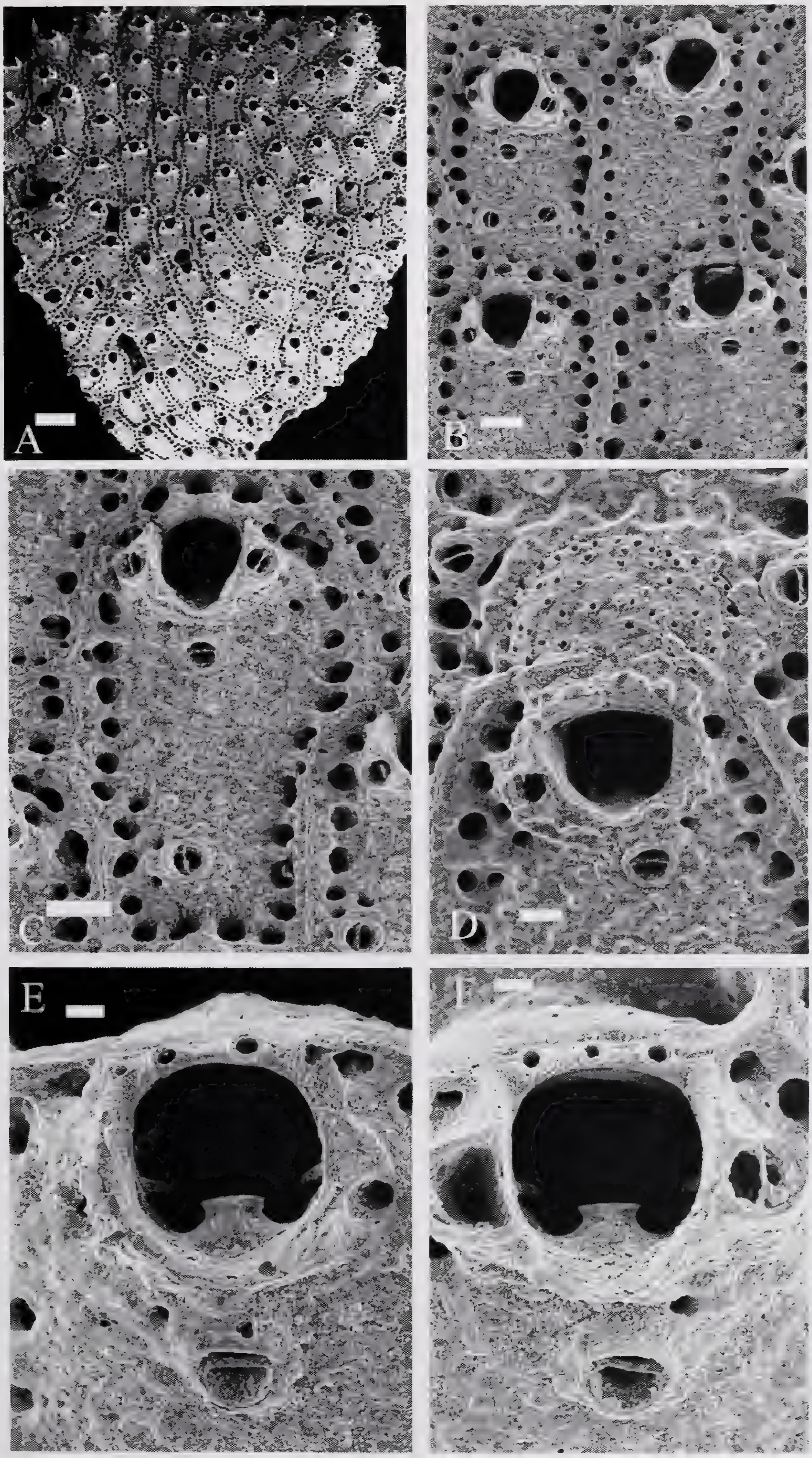

Figure 16. *Smittoidea reginae*. Hassler Box 15. MCZ 100124. A. Encrusting colony fragment. Scale bar = 500 μm. B. Four autozooids. Scale bar = 100 μm. C. Close-up of a single autozooid, showing three avicularia around the peristome and a single proximal avicularium. Scale bar = 100 μm. D. Ovicelled zooid. Scale bar = 100 μm. E. Close-up of an orifice with two distal spines. Scale bar = 20 μm. F. Another orifice with three distal spines. Scale bar = 20 μm.

Holotype. MCZ 100126. Hassler Box 11, Barbados, 100 fm. December 1871.

Etymology. From the Latin adjective *salebrosus*, rough, rugged, uneven, for its unevenly calcified frontal wall.

Description. Colony encrusting, small in size, with sexual reproduction initiated early in astogeny (Fig. 19A). Zooids small, oval to irregularly polygonal in shape, semierect with a flat proximal end and a raised distal end. Frontal wall texture rough and thickened with a few very small frontal pores and a row of larger marginal pores. Primary orifice without a lyrula (Figs. 19B, F). Secondary orifice keyhole shaped, with a transversely oval anterior portion and a straight-sided U-shaped sinus. Peristomial collar flat-topped with six to seven hollow jointed oral spines. Ovicells round, partly immersed, with scattered round pores (Figs. 19C, D). Only two spines visible on ovicelled zooids. Small oval, frontal avicularia with crossbars occur on some zooids.

Measurements

	Range	Mean	*N*
Lz	0.364–0.491	0.431	6
Wz	0.328–0.400	0.355	6
Lo	0.091–0.109	0.100	6
Wo	0.091–0.109	0.103	6
Lov	0.200–0.218	0.209	2
Wov	0.182–0.218	0.200	2

Diagnosis. *Parkermavella* species with six to seven hollow orificial spines, few marginal pores, a round, embedded ovicell with about about 29 pores, some with raised rims, and small oval avicularia on frontal walls of some zooids.

Notes. This is the first species of the genus described from the Atlantic. The other known species have Indo-Pacific distributions. The species also resembles members of the genus *Hemismittoidea* from Hawaii (Soule and Soule, 1973) in its small colony size and general morphology, but lacks the lyrula and avicularia characteristic of that genus.

Distribution. Barbados.

Specimens Examined. MCZ 100126. Hassler Box 11, Barbados, 100 fm, December, 1871.

Genus *Hippoporina* Neviani, 1895

Hippoporina rutelliformis new species

Figure 20

Holotype. MCZ 100127. Hassler Box 2, Barbados, 80 fm. December 1871.

Etymology. From the Latin diminutive of spade, *rutellum*, a small spade or shovel, descriptive of the spade-shaped opening of the avicularia.

Description. Colony encrusting (Fig. 20A). Zooids oval to polygonal in shape. Frontal surface slightly convex, with numerous depressed pores, except around the orifice. Raised lateral walls clearly distinguish zooid margins. Orifice with semicircular anter and wide, barely concave sinus, with two small rounded condyles. Single or paired, flat oval avicularia with crossbar and small columella (Fig. 20B), directed distally to distolaterally, are found beside and just below the orifice. Ovicells (Figs. 20A, D) are large relative to zooid size and have a flattened globular shape. Ovicell opening via maternal zooid operculum. Possible ancestrula (Fig. 20F) similar in shape to autozooids, with four thick oral spines or projections.

Measurements

	Range	Mean	*N*
Lz	0.491–0.746	0.604	6
Wz	0.400–0.546	0.470	6
Lo	0.127–0.164	0.149	6
Wo	0.146–0.173	0.155	6
Lov	0.382–0.437	0.410	2
Wov	0.382–0.400	0.391	2
Lav	0.146–0.182	0.161	6
Wav	0.109–0.146	0.121	6

Diagnosis. *Hipporina* with depressed oval avicularian outlines and spade-shaped openings around skeletal support for mandibles.

Notes. We have tentatively placed this species in *Hippoporina*. The diagnosis of *Hippoporina* given in Hayward and Ryland (1999) states that there are no oral spines in species of the genus. However, the overall morphology of the above species, and in particular, its orifice, is more similar to *Hippoporina* than to *Calyptotheca*, another genus that supposedly lacks spines, but in which at least in one species, *Calyptotheca*

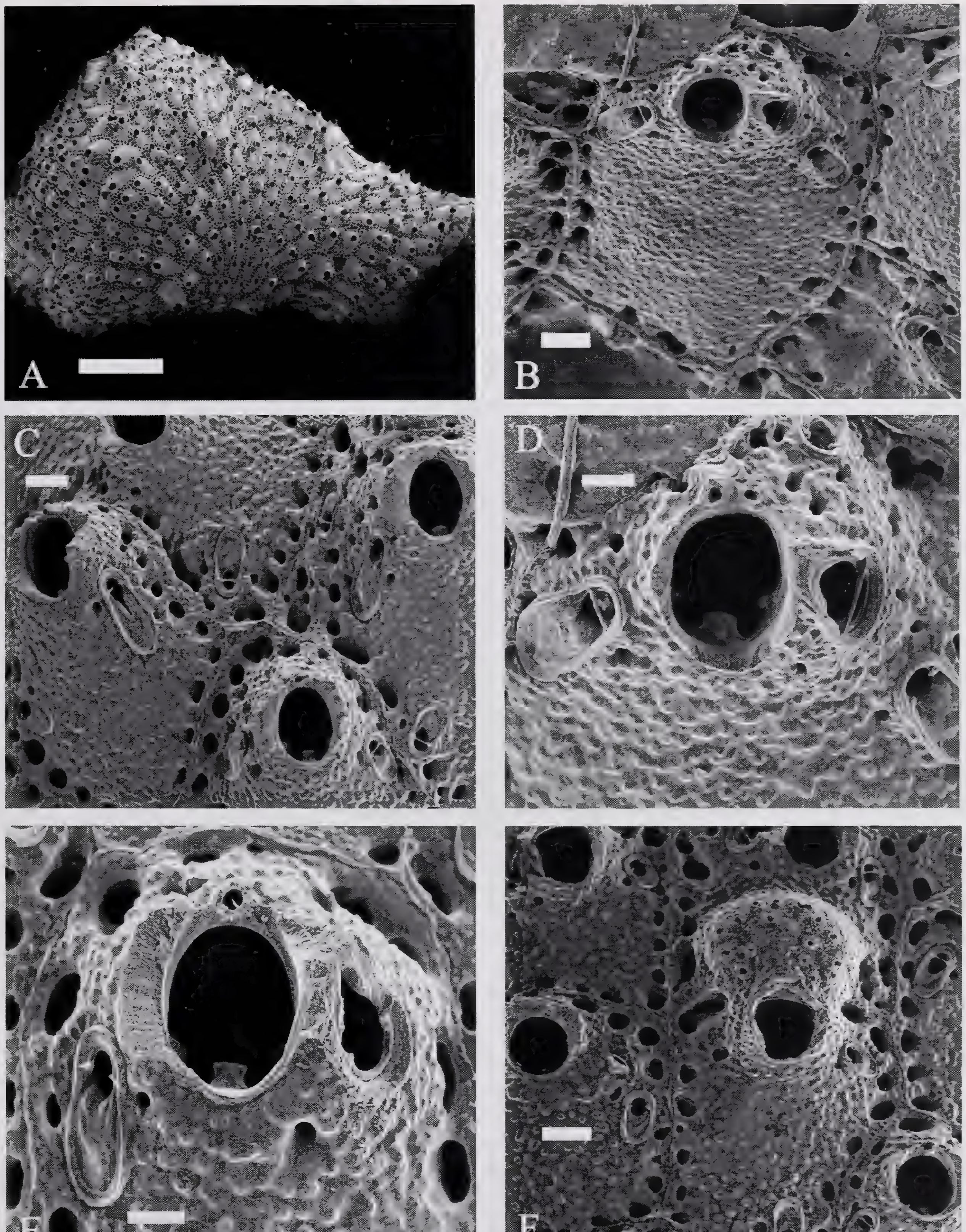

Figure 17. *Parasmittina barbadensis-1*. Hassler Box 12-3. MCZ 100125. A. View of piece of encrusting colony. Scale bar = 2 mm. B. Autozooid with oval and triangular avicularia. Scale bar = 100 μm. C. Zooids with oval and more elongate avicularia. Scale bar = 100 μm. D. Distal end of zooid with two spines. Note narrow lyrula and beaded distal rim of orifice. Scale bar = 50 μm. E. Zooid orifice with one distal spine. Scale bar = 50 μm. F. Ovicelled zooid. Scale bar = 100 μm.

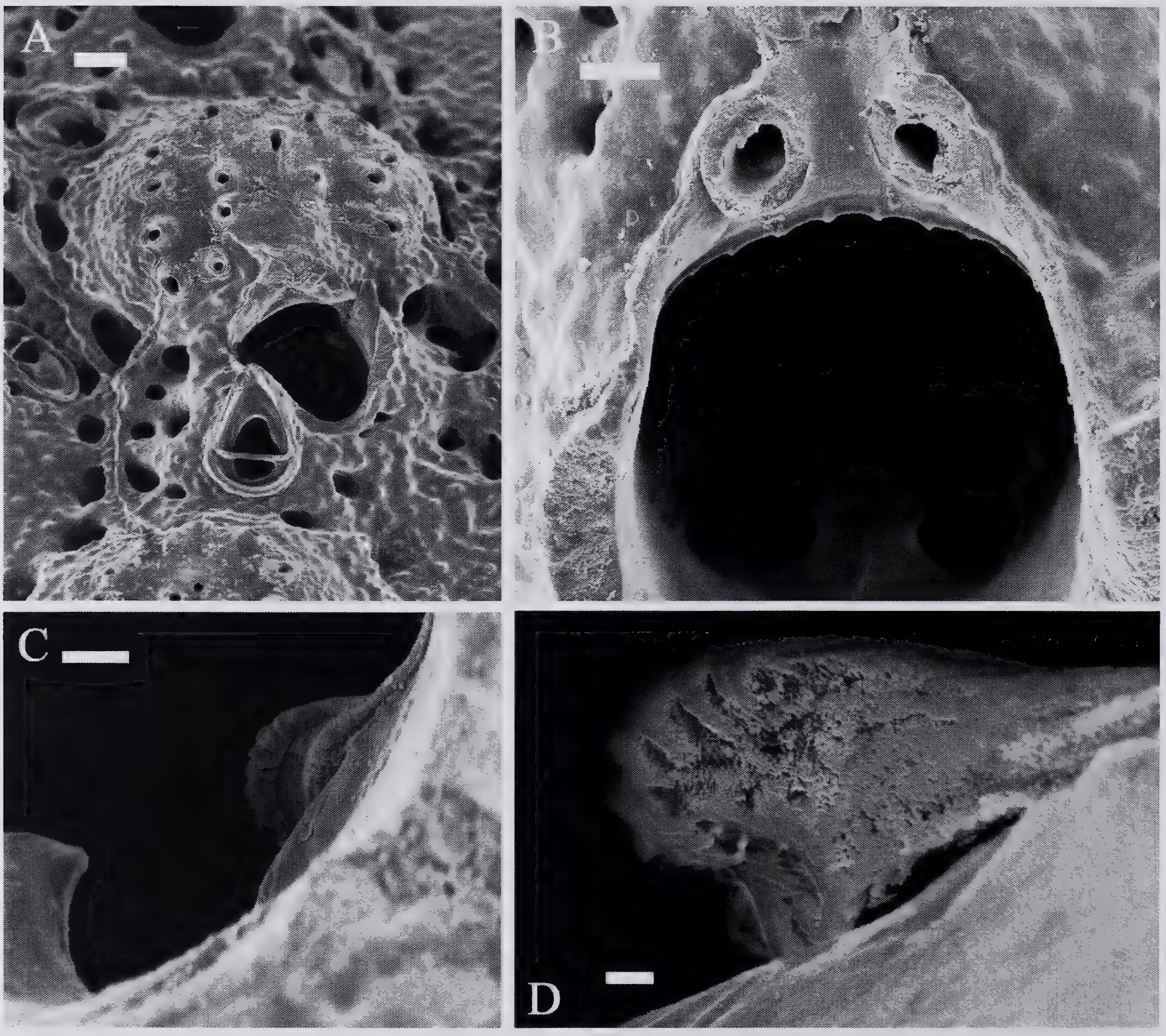

Figure 18. *Parasmittina barbadensis-2.* A. Close-up of another ovicelled zooid. Scale bar = 50 μm. B. Magnified view of orifice to show narrow lyrula and denticulate condyles. Scale bar =20 μm. C. Greatly magnified view of condyle. Scale bar =10 μm. D. Another condyle at higher magnification. Scale bar = 2 μm.

rugosa Hayward, 1974, has oral spines initially that diminish away from the ancestrual region (Hayward and McKinney, 2002, p. 76).

Distribution. Barbados.

Specimens Examined. MCZ 100127. Hassler Box 2, Barbados, 80 fm. December 1871.

Genus *Metroperiella* Canu & Bassler, 1917
Metroperiella agassizi new species
Figure 21

Codonellina montferrandii Lagaaij, 1963: 196, pl. VI, fig. 3. NOT *Flustra montferrandii* Audouin, 1826: 240.

Holotype. Codonellina agassizi. MCZ 100128. Hassler Box 11, Barbados, 100 fm. December 1871.

Etymology. Named in honor of Louis Agassiz.

Description. Colony encrusting, unilaminar (Fig. 21A). Zooids oval to polygonal in shape, zooid margins well defined by the raised rims of adjoining lateral walls (e.g., Figs. 21B, C). Frontal shield convex and finely and evenly porous. Orifice (Fig. 21D) horseshoe-shaped, anterior portion transversely oval with short, pointed condyles, posterior portion shallowly U-shaped. It is surrounded by a low peristomial collar with

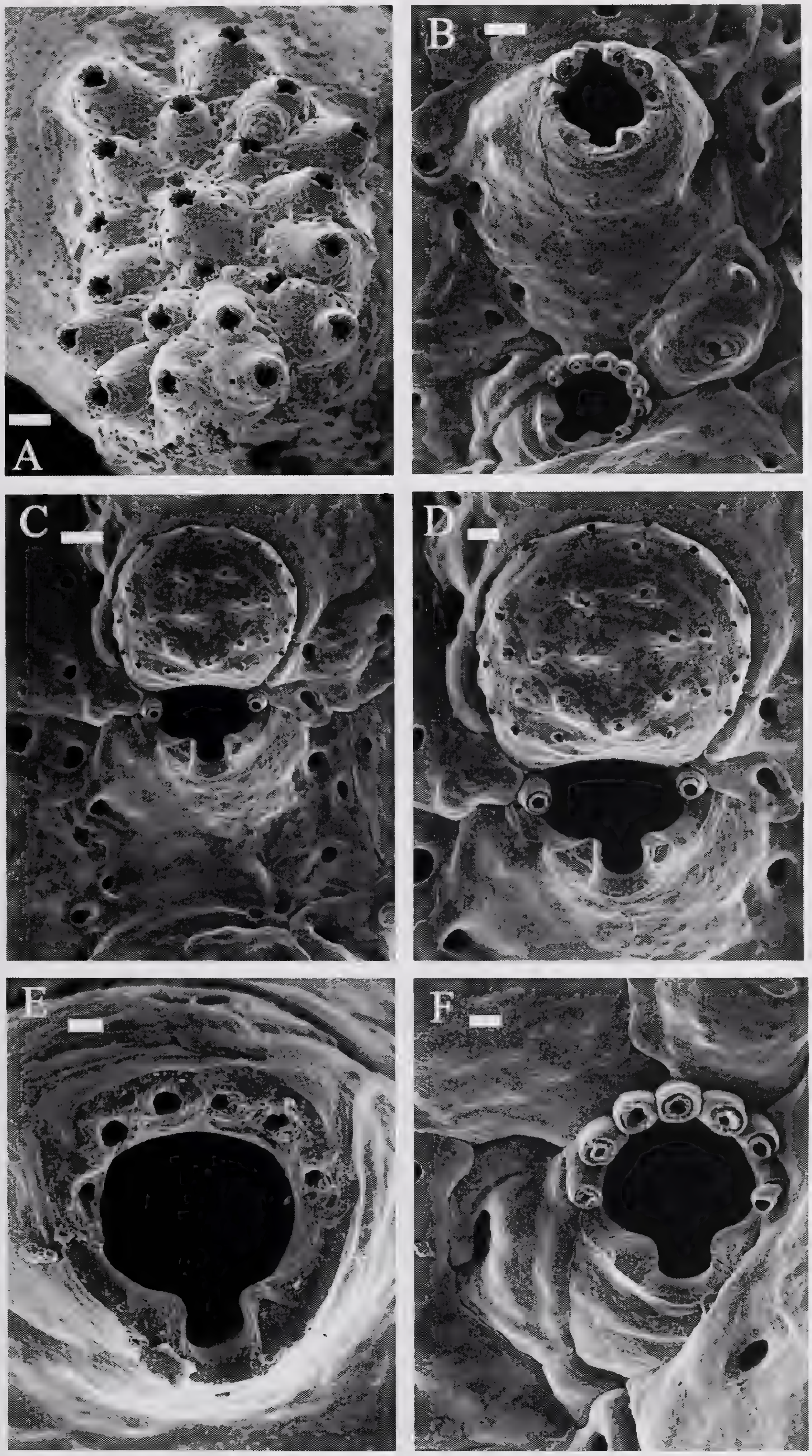

Figure 19. *Parkermavella salebrosa.* Hassler Box 11. MCZ 100126. A. Entire colony. Scale bar = 200 μm. B. Morphology of autozooid. Scale bar = 50 μm. C. Ovicelled zooid. Scale bar = 50 μm. D. Close-up of ovicell and orifice of maternal zooid. Scale bar = 25 μm. E. Orifice with six distal spines. Scale bar = 20 μm. F. Orifice with seven distal spines. Scale bar = 20 μm.

raised lateral lappets. Frontal avicularia with a rounded base, crossbar, and a narrow triangular rostrum are oriented proximolaterally and located below and slightly to one side of the midpoint of the proximal margin of the orifice (Figs. 21C–F). Ovicells globular, prominent, with an imperforate proximal rim, and with the rest of its frontal surface perforated by about 30–40 round pores (Fig. 21E). Ovicell closed by maternal zooid operculum.

Measurements

	Range	Mean	*N*
Lz	0.637–0.801	0.716	6
Wz	0.455–0.528	0.485	6
Lo	0.146–0.182	0.168	6
Wo	0.127–0.146	0.137	6
Lov	0.218–0.364	0.270	6
Wov	0.255–0.309	0.276	6
Lav	0.146–0.182	0.156	6
Wav	0.073–0.082	0.077	6

Diagnosis. *Metroperiella* with monomorphic, narrow, sharp-pointed, and asymmetrically placed avicularia. In comparison, Indo-Pacific species have two or three types of avicularia, smaller pointed avicularia and large spatulate avicularia and more oval, less sharply pointed avicularia in a more centered position below the orifice and smaller relative to zooid size (e.g., Harmer, 1957; Tilbrook, 2006).

Notes. Tilbrook (2006) has recently reviewed the species and listed the specimens he examined. *Metroperiella montferrandii* may be truly circumtropic, having been recorded from west Africa, the Mediterranean, and Indo-Pacific and eastern Pacific (Galapagos). It may also represent a complex of closely related species. Tilbrook (2006) describes one such new species, *Metroperiella circumflexa*, from the Solomon Islands and discusses another, *Metroperiella biformis* (Zhang and Liu, 1995), from China.

Distribution. Gulf of Mexico, Caribbean.

Specimens Examined. MCZ 100129. Hassler Box 2, Barbados, 80 fm. December 1871. MCZ 100128. Hassler Box 11, Barbados 100 fm. December 1871.

Superfamily Schizoporelloidea Jullien, 1883
Family Schizoporellidae Jullien, 1883
Genus *Stylopoma* Levinsen, 1909

cf *Stylopoma smitti* Winston, 2005
Figure 22A–C

Hippothoa spongites Smitt, 1873: 42 (in part).
Hippothoa or *Schizoporella spongites* Verrill, 1900: 592. ???
Schizoporella spongites Osburn, 1914: 207 (at least in part).
Stylopoma spongites Long & Rucker, 1970: 19, fig. 3:6; Winston, 1982: 146, fig. 78.
Stylopoma smitti Winston, 2005: 72, figs. 190–195.

Description. Colony encrusting to multilaminar (Fig. 22A). Zooids of primary layer of colony oval to rounded quadrangular; zooids of frontally budded layers irregularly polygonal. Frontal wall convex, granular, heavily calcified, with numerous medium-sized pores (Fig. 22B). Orifice positioned just below the distal rim, often slightly off center. Anterior part of orifice semicircular, posterior part flat with a central deeply slit, U- to almost teardrop-shaped sinus (Fig. 22C). Tab-shaped condyles extend almost to the sinus. A granular-textured umbo often may occur on the frontal wall just below the sinus. A low beaded peristomial rim surrounds the orifice. Small cross-barred avicularia, rounded proximally, with an equilaterally triangular mandible, occur on the frontal wall, at or below the level of the sinus and directed distolaterally. Occasional large spatulate, interzooidal avicularia may also occur. No ovicells were present on the Barbados specimens, but those of Florida specimens of *Stylopoma smitti* are large and spherical, covering part of the frontal surface of several zooids. They have a rough-textured surface covered with smaller and more closely spaced pores than those of zooid frontal walls, but no avicularia (see Winston, 2005, fig. 198).

	Lz	Wz	Lo	Wo	Lav	Wav
N	6	6	6	6	6	6
Mean mm	0.528	0.355	0.121	0.127	0.067	0.053
St Dev mm	0.064	0.038	0.009	0.010	0.009	0.004
Range						
min	0.419	0.309	0.109	0.118	0.055	0.046
max	0.601	0.419	0.127	0.146	0.073	0.055

Notes. Zooids of this young colony have orifices that are more U- than teardrop-shaped and have shorter, more curved condyles than orifices of the larger fragment found. This may

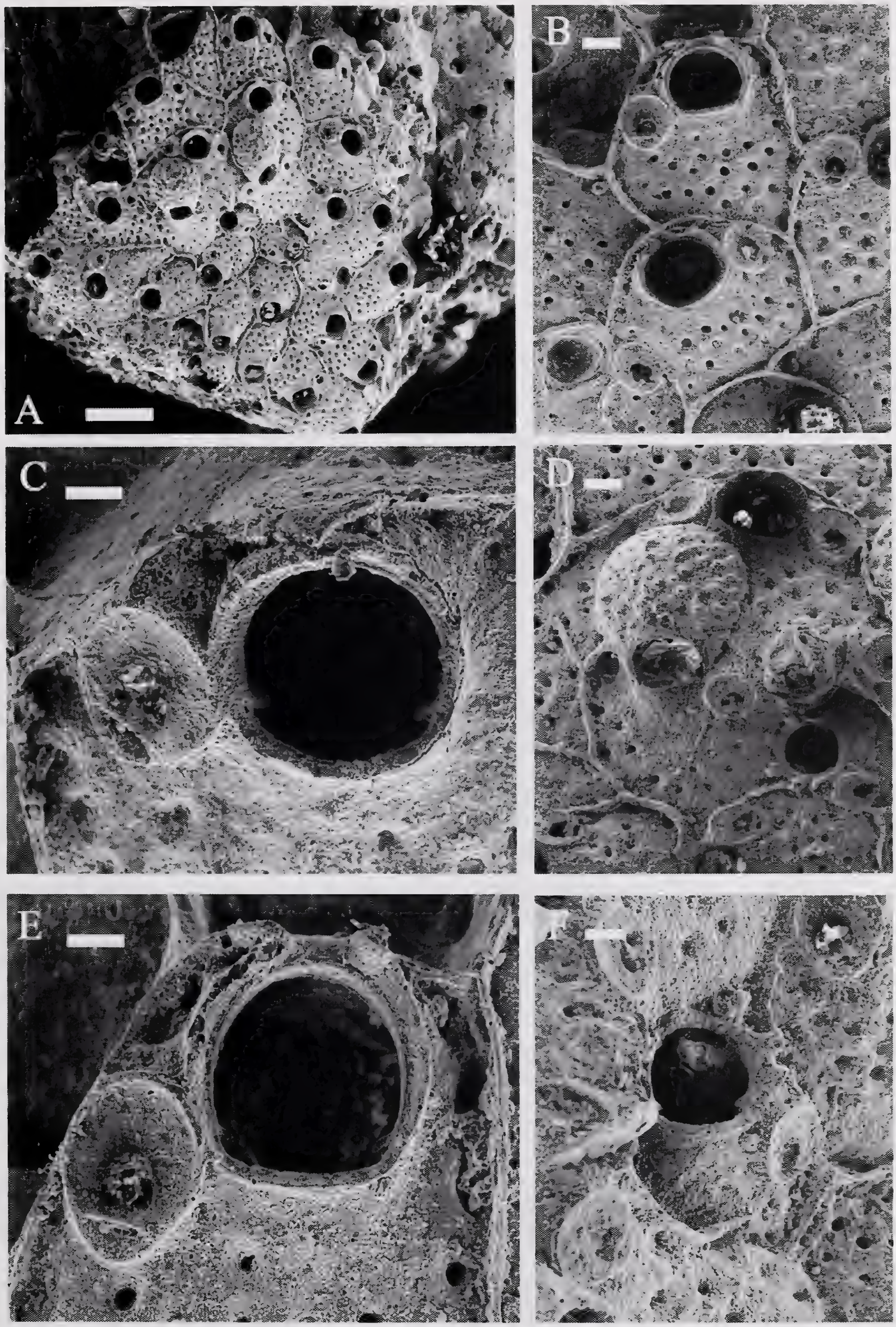

Figure 20. *Hippoporina rutelliformis*. Hassler Box 2. MCZ 100127. A. Low-magnification view of most of encrusting colony. Scale bar = 50 μm. B. Two autozooids near growing edge. Note shape of calcified parts of avicularia. Scale bar = 100 μm. C. Orifice, showing small blunt pointed condyles. Scale bar = 50 μm. D. Ovicelled zooid. Scale bar = 100 μm. E. Zooid at growing edge with two oral spines. Scale bar = 50 μm. F. Ancestrula or pseudoancestrula with spiny processes around the orifice peristome. Scale bar = 50 μm.

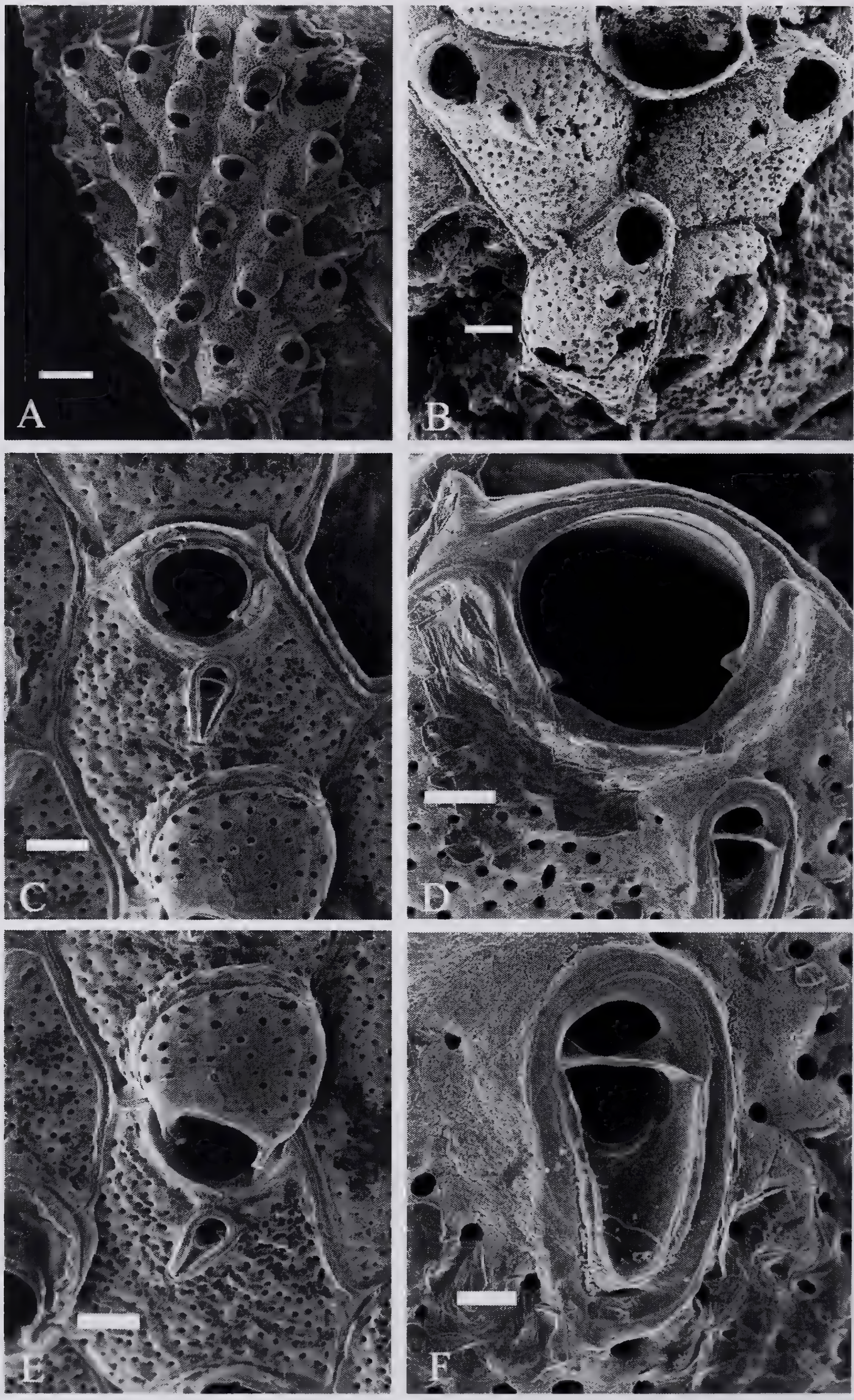

Figure 21. *Metroperiella agassizi*. Hassler Box 11. MCZ 100128. A. View of most of a small colony. Scale bar = 500 μm. B. Skeletal and partially broken zooids, showing shape and position of frontal avicularia. Scale bar = 100 μm. C. Single autozooid to show orifice shape and position and orientation of frontal avicularium. Scale bar = 100 μm. D. Close-up of orifice of zooid at the growing edge of colony. Scale bar = 50 μm. E. An ovicelled zooid. Scale bar =100 μm. F. Close-up of an avicularium. Scale bar = 20 μm.

reflect astogenetic variation, i.e., the zone of astogenetic change, vs. the zone of astogenetic repetition, but considering the importance of orifice morphology in *Stylopoma* species (and other cheilostomes as well), the two are here considered to represent different species. Both species have orifices with a noticeably granular distal peristome rim, similar porous frontal walls, and broad, triangular frontal avicularia tilted forward and directed distolaterally. However, in addition, the orifice of the Barbados *S. smitti* is closer to the zooid center than to lateral walls, zooids are flatter, and frontal avicularia are smaller.

Distribution. Florida, Barbados.

Specimens Examined. MCZ 100130. Hassler Box 1-2. Barbados, 80 fm. December 1871.

Stylopoma haywardi new species
Figures 22 D–F

Holotype. MCZ 100131. Hassler Box 1-1, Barbados, 80 fm. December 1871.

Etymology. Named in honor of bryozoan taxonomist, Peter J. Hayward.

Description. Colony encrusting in one or more layers. Zooids of primary layer of colony (only layer present on this colony) rounded quadrangular (Figs. 22E, F). Frontal wall granular, heavily calcified, with numerous medium-sized pores, and fairly flat except for an imperforate median umbo. Orifice positioned just below the distal rim, quite off center, almost to the lateral edge of the zooid, except in the case of zooids with two avicularia (see Fig. 22E). Anterior part of orifice semicircular, posterior part flat, with a central deep teardrop-shaped sinus. Broad straight condyles extend almost to the inner edges of the sinus (Fig. 22D). A low beaded peristome rims the orifice. Small cross-barred avicularia, rounded proximally, with an equilaterally triangular mandible, occur on the frontal wall, at about the level of the sinus. They have a raised beaded rostrum and are directed distolaterally. Paired frontal avicularia occur on some zooids. Occasional large spatulate interzooidal avicularia (Fig. 22F) may also occur. No ovicells were present on the Barbados specimens.

	Lz	Wz	Lo	Wo	Lav	Wav
N	6	6	6	5	6	6
Mean mm	0.497	0.343	0.112	0.124	0.077	0.056
St Dev mm	0.038	0.033	0.012	0.008	0.014	0.007
Range						
min	0.455	0.309	0.091	0.109	0.055	0.046
max	0.546	0.400	0.127	0.127	0.091	0.064

Diagnosis. Encrusting *Stylopoma* with the following distinguishing suite of autozooid characters: zooids flat except for large median umbo, orifice with condyles in the form of long bars, sinus an elongate keyhole shape, triangular frontal avicularia on one or both sides the orifice, orifice close to a lateral wall of zooid, except when avicularia are paired, elongate spatulate avicularia.

Notes. The Caribbean is known to be diverse in *Stylopoma* species, with more than 15 known, although not all have been described and named. *Stylopoma haywardi* can be distinguished from the following Caribbean species on the basis of autozooid characters, despite the lack of ovicells in the colony found. *Stylopoma smitti* has more convex zooids with a more centered orifice having up-curved, tab-shaped condyles, and a less constricted, more U-shaped sinus. It is one of the smallest species, in terms of autozooid length and width, but the other species with small zooids, *Stylopoma minuta*, has a more centered orifice, a more convex, distally raised frontal surface, and a very broad spatulate avicularium. Autozooids of *Stylopoma haywardi* resemble those of *Stylopoma projecta* in having an orifice with bar-shaped condyles and keyhole-shaped sinus, but *S. projecta* can be tubular erect, as well as encrusting, in growth form, has longer and narrower zooids, and much narrower frontal avicularia that are often paired and also scattered on other parts of frontal surface, not just around the orifice. Specimens from Belize cryptic reef habitats (Winston, 1984), called *Stylopoma spongites* in that work, have a larger size, tabbed condyles, and pointed spatulate avicularia.

Distribution. Barbados.

Specimens Examined. MCZ 100131. Hassler Box 1-1, Barbados, 80 fm. December 1871.

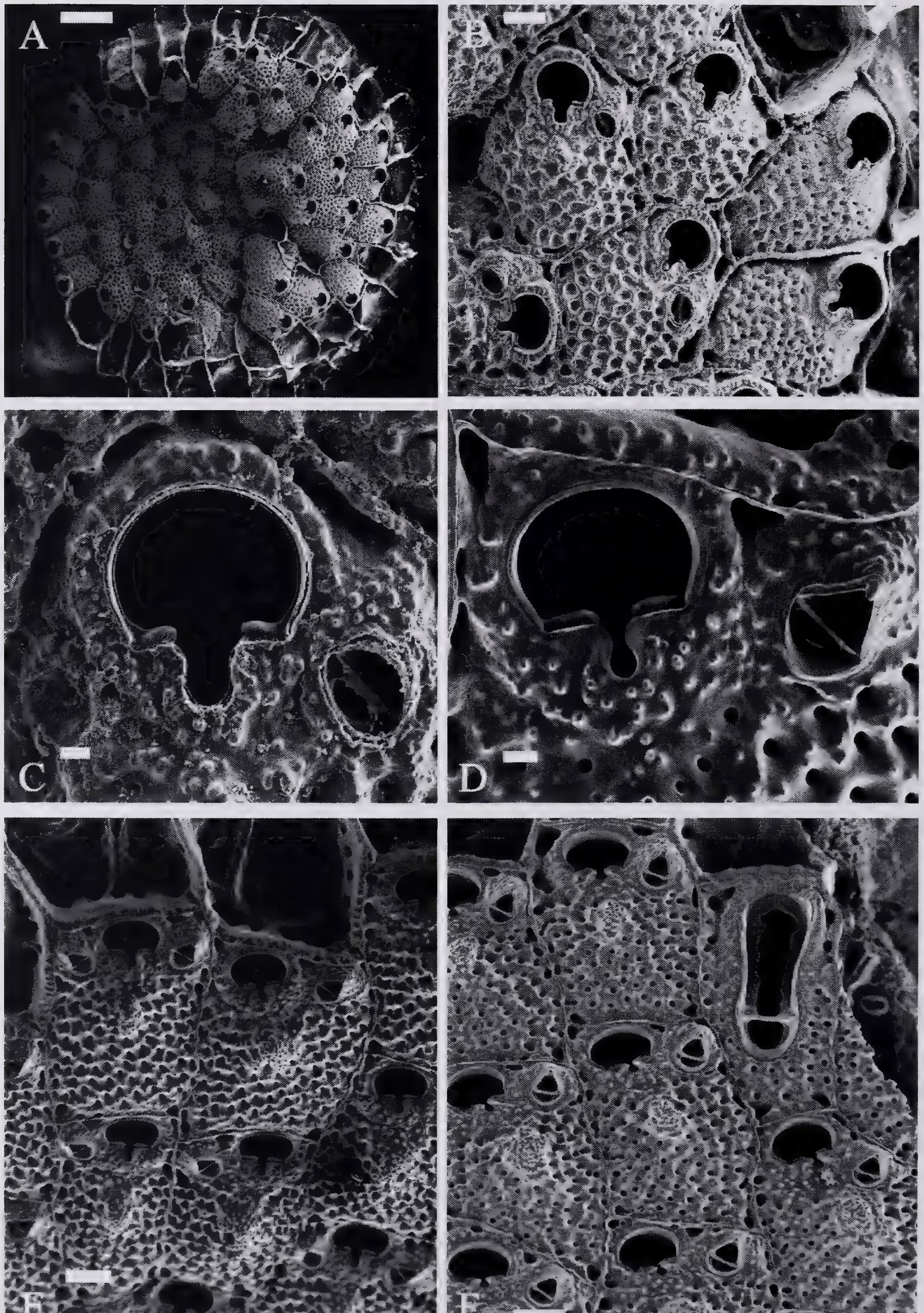

Figure 22. *Stylopoma smitti* and *Stylopoma haywardi*. (A–C, *S. smitti*, Hassler Box 1-2. MCZ 100130.) A. Entire juvenile colony. Scale bar = 500 µm. B. Group of autozooids at growing edge of colony. Scale bar = 100 µm. C. Distal end of autozooid of same colony showing orifice shape and small frontal avicularium. Scale bar = 200 µm. (D–F, *S. haywardi*, Hassler Box 1-1. MCZ 100131.) D. Orifice of zooid from second colony to show orifice shape and morphology of frontal avicularium. Scale bar = 20 µm. E. Group of autozooids of this colony near growing edge. Scale bar = 100 µm. F. Another group of zooids showing large spatulate interzooecial avicularium. Scale bar = 100 µm.

Family Gigantoporidae Bassler, 1935
Genus *Barbadiopsis* new genus

Etymology. Named after the island where it was collected on the *Hassler* Expedition.

Description. Zooids very large in size, proximal frontal wall with small pores or almost imperforate, distal wall swollen and raised by the large cystids of paired avicularia, whose elongate triangular rostra are directed distolaterally or laterally over the orifice. Avicularian mandibles are distinct, long, pointed, and curving with a serrated edge and winglike central expansions. Primary orifice hoof-shaped, with small but noticeable condyles and immersed in a rounded peristome. Ovicells with small frontal pores lost with increasing calcification or initially with only marginal pores apparent. Type species, *Barbadiopsis trepida*, new species. Other species included in this genus, *Barbadiopsis* (*Cosciniopsis*) *rubra* (Osburn, 1940).

Diagnosis. The genus is characterized by very large, rough-textured zooids, with large-bodied, raised avicularia surrounding the orifice and oriented toward each other. The avicularia have curved, pointed mandibles with serrations and a lateral expansion along one side.

Notes. The Caribbean reef-associated species *Gephyrophora rubra* Osburn, 1940 was synonymized by Cook (1985) under *Aptonella violacea* Canu & Bassler, 1928b. Tilbrook et al. (2001) disagreed with this decision, placing Osburn's species in *Cosciniopsis*. This is a better fit in terms of frontal wall and orifice, but the very enlarged avicularia with their unique winged mandibles shared by the two Caribbean species seemed to us to merit a separate genus within the Gigantoporidae.

Barbadiopsis trepida new species
Figures 23, 24

Holotype. MCZ 100132. Hassler Box 15, Barbados, 100 fm. December 1871.

Etymology. From the Latin adjective *trepidus* = anxious, alarmed, because of the raised eyebrow orientation of the paired oral avicularia.

Description. Colony nodular, encrusting; coarse-textured due to the large size and shape of the partially erect zooids (Fig. 23A). Zooids very large, oval to almost circular in frontal view. Frontal wall imperforate except for a few marginal pores. Primary orifice hoof-shaped, longer than wide, with short condyles and a U-shaped proximal portion. A raised peristome with lateral lappets extends into a partial peristomial bridge above the orifice (Fig. 23B). Bulbous paired avicularia with coarsely porous calcification are raised on either side of the orifice, their mandibles pointing distolaterally toward each other (Fig. 24A). The mandible is elaborate, a narrow spear-shaped central spine with a thin shallow distal wing with short serrations along its distal edge (Figs. 24B–D). Ovicells prominent, globular, with granular calcification and few pores. Ovicells open into zooid peristomes.

Measurements

	Range	Mean	*N*
Lz	0.728–1.019	0.861	6
Wz	0.601–0.946	0.719	6
Lo	0.200–0.237	0.215	6
Wo	0.146–0.200	0.179	6
Lov	0.291–0.291	0.291	1
Wov	0.382–0.382	0.382	1
Lav	0.200–0.309	0.252	6
Wav	0.109–0.182	0.133	6

Diagnosis. *Barbadiopsis* with proximal frontal wall imperforate, distal wall swollen and raised by large paired avicularia whose elongate triangular mandibles are directed distolaterally, their tips meeting above the orifice. The peristome may form a partial bridge across the orifice.

Notes. In the Caribbean species *B. rubra* Osburn (1940) the proximal frontal surface is also coarsely granular but with small pores interspersed, and the raised paired avicularia are directed laterally across the orifice rather than above it. Canu and Bassler (1928b) described *Barbadiopsis imperfecta* from Brazil. It has more distally pointed avicularia, a raised umbo beneath the orifice, and a finely granulose and porous frontal wall.

Distribution. Barbados

Specimens Examined. MCZ 100132. Hassler Box 15, Barbados, 100 fm. December 1871.

Family Teuchoporidae Neviani, 1895
Genus *Lagenicella* Cheetham & Sandberg, 1964
Lagenicella verrucosa (Canu & Bassler, 1928)
Figure 25

Lagenipora verrucosa Canu & Bassler 1928:137, pl. 21, figs. 5–8. Osburn, 1947: 41.

Description. Colony encrusting, uniserial, branching, creeping over calcareous substrata, and sometimes intertwined with species with vinelike growth (e.g., Figs. 25A, B). Zooid shape is elongate-oval and shallowly convex up to the distal end, which rises into a thick, imperforate tubular peristome around the orifice. Lateral walls are smoothly calcified with pores apparent. Zooid frontal walls (except for the peristome) have numerous small pores and between them, rough-textured calcification in the form of tubercles and forked spines (Fig. 25D). Some zooids, as Canu and Bassler pointed out in their original description, are much more verrucose than others. The primary orifice is elliptical, longer than wide, and can only be seen on developing zooids (Fig. 25C). Avicularia are lacking, although there appear to be paired pores or slight projections on the lateral sides of peristome rims of some zooids. Ovicells are hemispherical, with a semicircular window showing the inner layer; calcification may bear projecting spines (Figs. 25E, F) but no pores. Ovicells are positioned on the outside distal wall of the peristome and open into the peristome.

Measurements

	Range	Mean	*N*
Lz	0.601–0.819	0.652	6
Wz	0.273–0.328	0.303	6
Lo	0.091–0.109	0.103	3
Wo	0.091–0.091	0.091	3
Lov	0.109–0.109	0.109	1
Wov	0.182–0.182	0.182	1
Lo2	0.091–0.146	0.132	4
Wo2	0.109–0.164	0.137	4

Notes. The taxonomic problem of which species belong to *Lagenicella* and which to *Lagenipora* hasn't been resolved. In frontal wall structure this species seems closest to *Lagenicella* as described by Cheetham and Sandberg (1964); however, it does not have avicularia, or pores in the ovicells.

Distribution. Caribbean.

Specimens Examined. MCZ 100133. Hassler Box 6, Barbados, 100 fm. December 1871.

Family Microporellidae Hincks, 1880
Genus *Microporella* Hincks, 1877
Microporella protea Winston, 2005
Figure 26

Porellina ciliata Smitt, 1873: 26, pl. VI, figs. 128–129. [not figs. 126, 127]. NOT *Eschara ciliata* Pallas, 1766: 38.

?*Microporella ciliata personata* Osburn, 1947: 36. NOT *Microporella personata* Busk, 1854: 74, pl. XC, figs. 24.

Microporella ciliata Long & Rucker, 1970: 20, fig. 4:3.

Microporella protea Winston, 2005: 78, figs. 211–213, 215, 217–223.

Description. Colony encrusting in one or more layers (Fig. 26A). Zooids irregularly rhomboidal in shape, with granular frontal surfaces penetrated by numerous irregularly shaped pores (Fig. 26B). Zooids separated by shallow grooves, becoming less distinct with age; junction of the intercalary cuticles of adjacent zooids wavy. Thickening and increasing irregularity of the frontal wall occurs as secondary calcification progresses, with pores becoming deeply sunken or obscured. Orifice semicircular, with no condyles, but with three to four hollow jointed oral spines and with granular-to-beaded calcification outside its proximal margin (Fig. 26C). A slightly raised collar surrounds the crescentic, denticulate ascopore located just below the orifice. Proximal to the ascopore at about the midpoint of the zooid length is a large, very broad, laterally directed avicularium with a complete crossbar. Globose ovicells, covered with the same thick granular-to-pustulose calcification as zooids, may show poorly developed ribs. The maternal zooid peristome curves around into two projecting arms (Fig. 26D) or forms a proximal bridge across the secondary orifice.

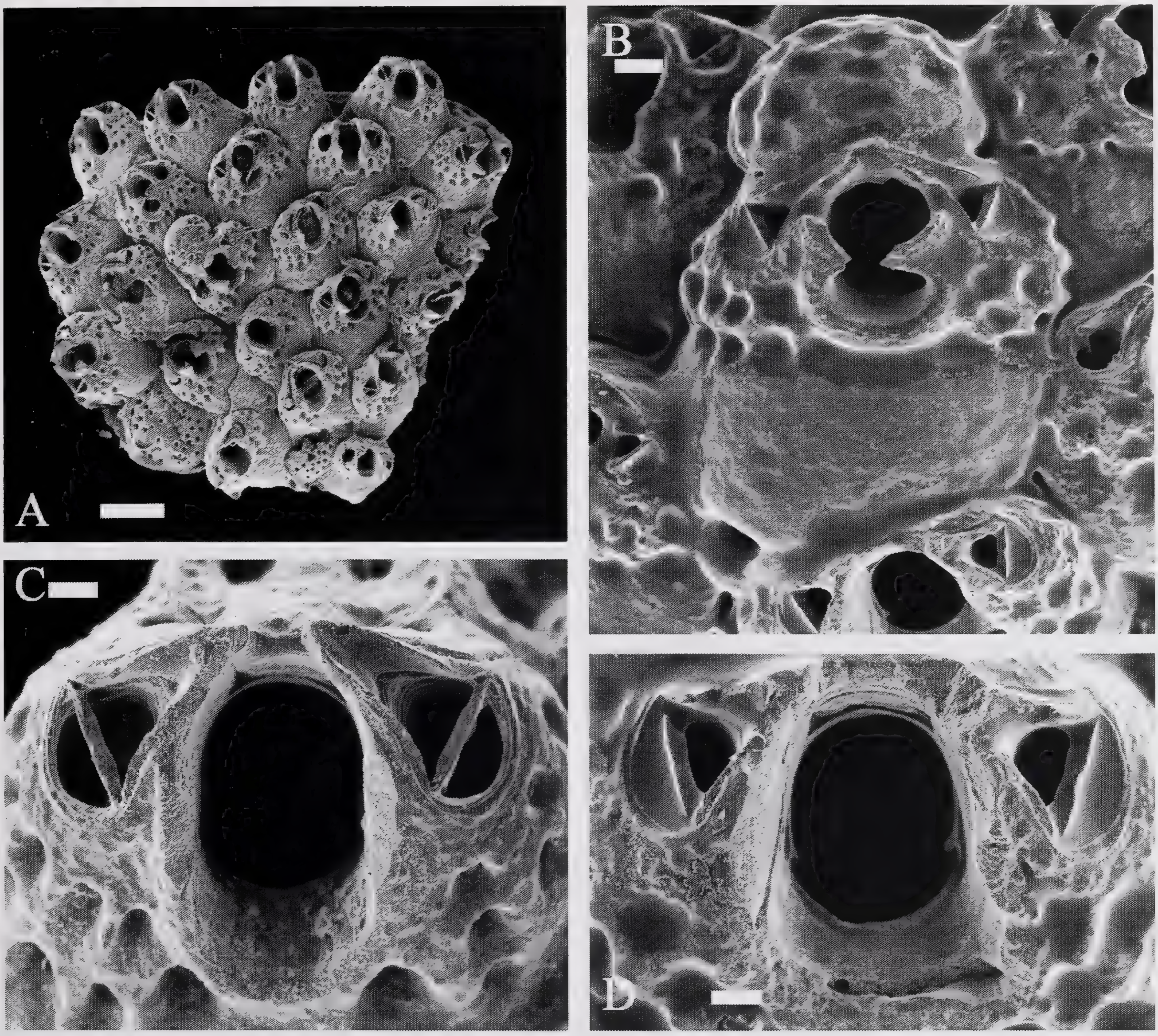

Figure 23. *Barbadioposis trepida-1.* Hassler Box 15. MCZ 100132. A. Small nodular colony. Scale bar = 500 µm. B. A single ovicelled zooid. Scale bar = 100 µm. E. Close-up of autozooid orifice and paired avicularia. Scale bar = 50 µm. D. Another autozooid orifice with its paired, raised avicularia. Scale bar = 50 µm.

Measurements

	Range	Mean	*N*
Lz	0.528–0.673	0.582	6
Wz	0.346–0.473	0.434	6
Lo	0.073–0.91	0.077	6
Wo	0.109–0.127	0.120	6
Lov	0.164–0.218	0.199	6
Wov	0.273–0.309	0.291	6
Lav	0.091–0.127	0.112	6
Wav	0.073–0.091	0.080	6

Notes. When the heavily calcified colonies encrust narrow substrata they may resemble erect branches (Fig. 26A).

Distribution. Florida, Barbados.

Specimens Examined. MCZ 100134. Hassler Box 12-1, Barbados, 80 fm. December 1871.

Family Escharinidae Tilbrook, 2006
Genus *Bryopesanser* Tilbrook, 2006
Bryopesanser pesanseris (Smitt, 1873)
Figure 27

Hippothoa pesanseris (Smitt 1873): 43.
Escharina pesanseris Osburn, 1914: 207; Cook, 1968:195; Long & Rucker, 1970: 19; Winston, 1982: 145; 1984; 26, figs. 53–55.

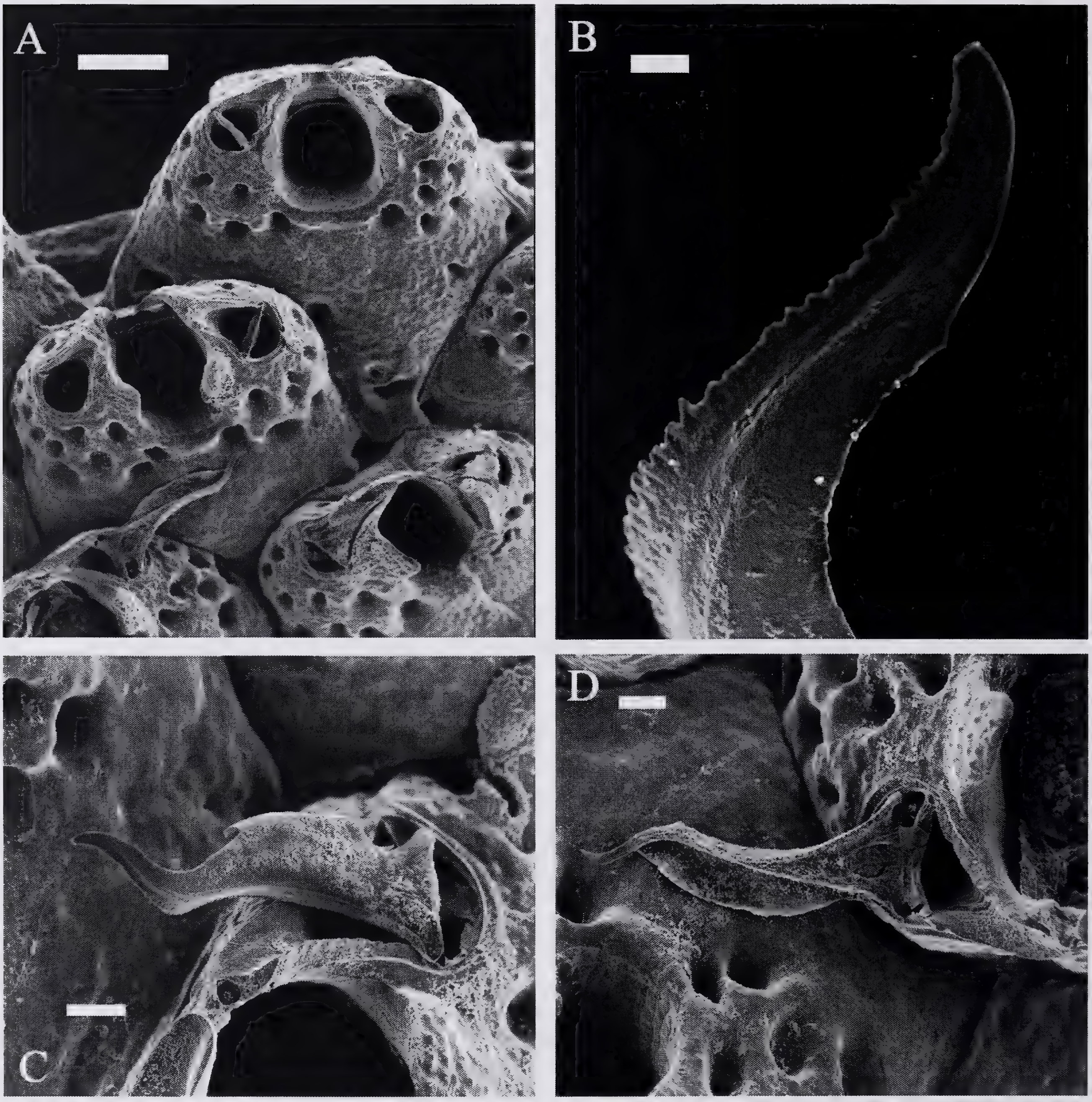

Figure 24. *Barbadioposis trepida-2.* A. Partially cleaned zooids, showing avicularian mandibles. Scale bar = 200 μm. B. Close-up of a single mandible. Note edge serrations. Scale bar = 10 μm. C. Avicularian mandible in closed position. Scale bar = 50 μm. D. Another mandible in open position. Scale bar = 50 μm.

Mastigophora pesanseris Osburn, 1927: 130; 1940: 452. Canu & Bassler 1928a: 133; Marcus 1939: 142.
Bryopesanser pesanseris Tilbrook, 2006: 253, pl. 55A–C

Description. Colonies encrusting, small, and single layered (Fig. 27). Zooids oval to subhexagonal, frontal shield calcification with a granular texture, perforated by many very small pores. Orifice semicircular with a small, narrow, teardrop-shaped central sinus. Around the orifice is a low flat-topped peristome with seven hollow spines along its distolateral rim. Paired avicularia have complete crossbars and pointed rostra, flared into a terminal groove to support the characteristic webbed "duck foot" mandibles. Ovicells (not present on the juvenile colony found in the Barbados collection) are small and globular, with no pores. Ancestrula (missing from colony illustrated here, but illustrated in Winston [1984, fig. 55]) almost identical to that of *Bryopesanser latesco*, an Indo-Pacific species described by Tilbrook (2006), with 10

spines and an opesia taking up the distal half of the zooid.

Notes. Tilbrook (2006) created the family Escharinidae, including in it the new genus *Bryopesanser*, with *Bryopesanser pesanseris* (Smitt) as the type species. Members of the genus are not uncommon in tropical and subtropical habitats, but the amount of variation within the genus has only recently been recognized, no doubt partly due to the small size and ephemeral life histories of its species.

Measurements. No measurements were made on this immature and partly broken colony that had settled on a dead *Steginoporella* zooid. Mean zooid length and width in mature Belize colonies was 0.54 × 0.39 mm (Winston, 1984).

Distribution. Warm waters of eastern and western Atlantic and Caribbean regions, possibly eastern Pacific also.

Specimens Examined. MCZ 100135. Hassler Box 12 on *Steginoporella magnilabris* specimen. Barbados, 100 fm, December 1871.

Superfamily Mamilloporoidea Canu & Bassler, 1927
Family Cleidochasmatidae Cheetham and Sandberg, 1964
Genus *Gemelliporina* Bassler, 1936
Gemelliporina hastata new species
Figure 28

Holotype. MCZ. 100136. Hassler Box 8, Barbados, 100 fm. December 1871.

Etymology. From Latin *hastatus -a -um* = armed with a spear, for its orificial avicularia.

Description. Colony unjointed, rigidly calcified, erect, with cylindrical branches (Fig. 28A). Zooids oval to rectangular in shape, frontal shield calcification imperforate except for marginal areolae and pustulose in texture (Figs. 28B and E). Zooids flat proximally, curved upward and outward into a peristome distally. Zooid margins slightly depressed, a scalloped line marking position of adjacent vertical walls. Primary orifice hidden by peristome (partially visible in Figs. 28C, D). Peristome opening has an asymmetrical sinus, on the side of which a small avicularium with a pointed rostrum is positioned (Fig. 28E). Ovicells rounded and slightly raised, outlined by pores, with scattered small pores and sometimes a large round central pore on their frontal surface (Figs. 28B, F).

Measurements

	Range	Mean	*N*
Lz	0.855–1.219	1.037	6
Wz	0.473–0.746	0.634	6
Lo	0.200–0.237	0.215	6
Wo	0.146–0.182	0.161	6
Lov	0.364–0.455	0.413	3
Wov	0.510–0.637	0.564	3
Lav	0.073–0.100	0.084	4
Wav	0.055–0.064	0.059	4

Diagnosis. Distinguished from the more common Caribbean species *Gemelliporina glabra* (Smitt) 1873 by its larger zooid size and by its raised peristome and peristomial avicularium. Distinguished from the fossil species *Gemelliporina punctata* (Canu & Bassler) 1919, which appears to have a similar round pore in the ovicell, by its peristomial avicularia and asymmetrical peristome sinus, as well by as its larger zooid size.

Notes. The material examined consisted of old basal portions of colonies in which the primary orifice (and presence of spines, if any) could not be observed. However, the overall morphology of the Barbados species corresponds well with those of the two other species known from the region, the fossil and Recent *G. glabra* (Cape Hatteras to Brazil, and Caribbean–Gulf of Mexico) and the fossil species *G. punctata* (Bowden bed, Miocene, Jamaica), so we have placed it with them in *Gemelliporina*.

Distribution. Barbados.

Specimens Examined. MCZ 100136. Hassler Box 8, Barbados, 100 fm. December 1871.

Superfamily Celleporoidea Johnston, 1838
Family Celleporidae Johnston, 1838
Genus *Buffonellaria* Canu & Bassler, 1927
Buffonellaria ensifera new species
Figures 29, 30

Holotype. MCZ 100137. Hassler Box 15, Barbados, 100 fm. December 1871.

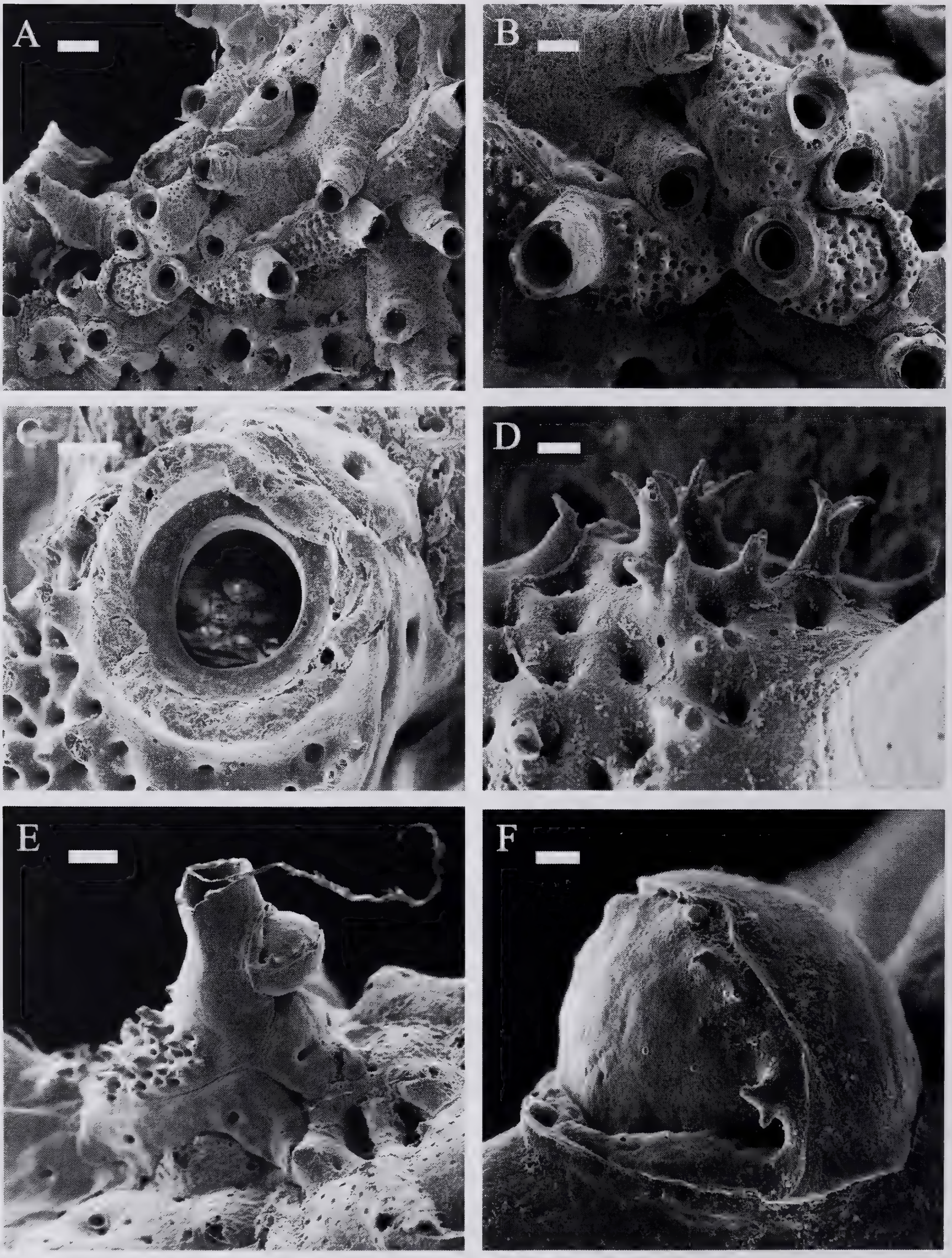

Figure 25. *Lagenicella verrucosa*. Hassler Box 6. MCZ 1000133. A. *Lagenicella* colony intertwined with cyclostome colony (*Proboscina*). Scale bar = 200 μm. B. Three *Lagenicella* zooids and adjacent cyclostome zooids. Scale bar = 100 μm. C. Orifice (near level of primary orifice and developing peristome). Scale bar = 50 μm. D. Spiny and knobby calcified projections on frontal shield. Scale bar = 20 μm. E. Ovicelled zooid in side view. Scale bar = 100 μm. F. Close-up of ovicell. Scale bar = 20 μm.

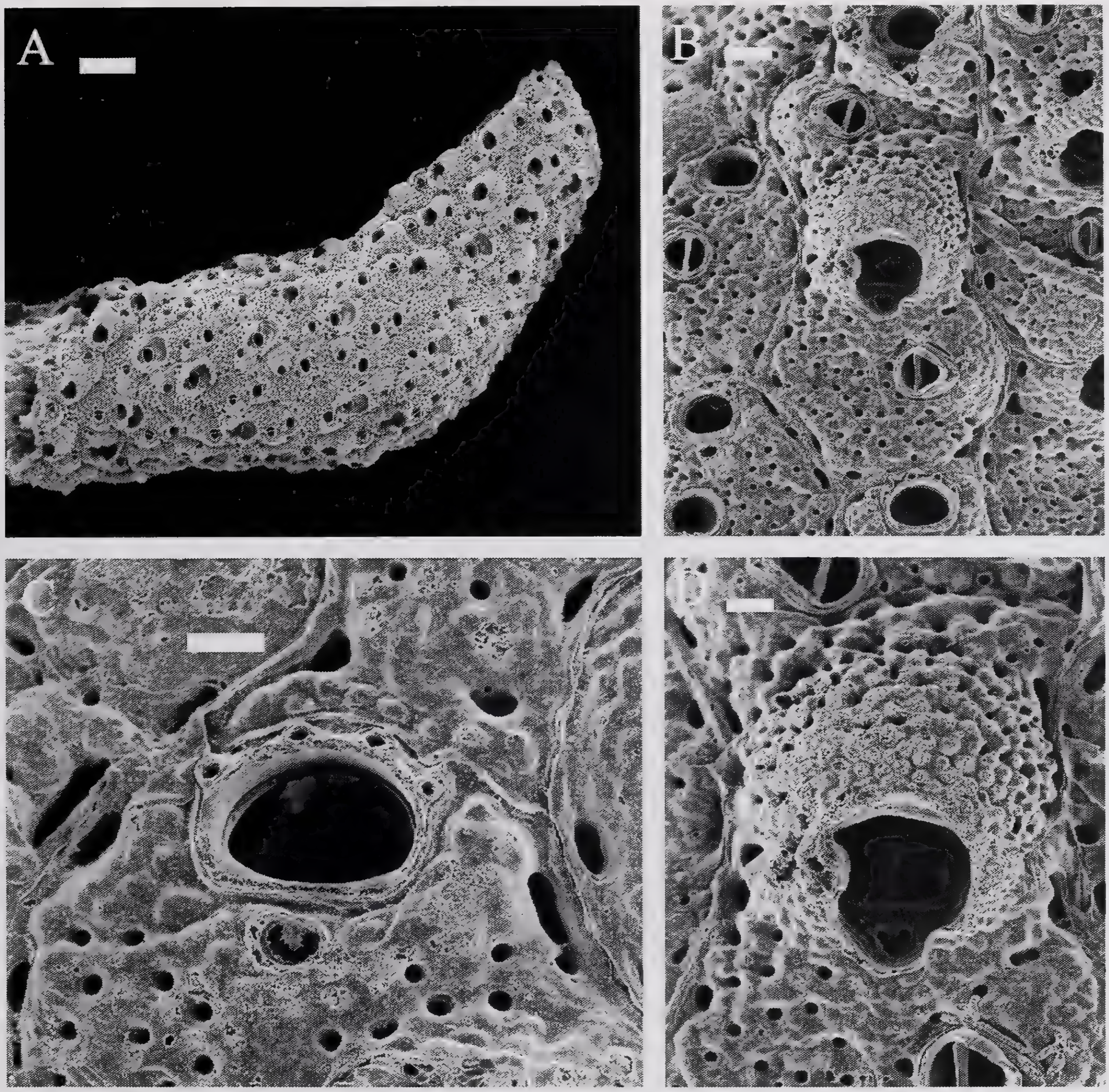

Figure 26. *Microporella protea*. Hassler Box 12. MCZ 100134. A. Colony encrusting a dead erect bryozoan. Scale bar = 500 μm. B. Group of zooids with ovicelled zooid at center. Scale bar = 100 μm. C. Close-up of orifice and ascopore. Scale bar = 50 μm. D. Close-up of ovicell, showing embedded ascopore. Scale bar = 50 μm.

Etymology. From the Latin adjective *ensifer -a -um,* sword-bearing.

Description. Colony encrusting in one or more layers (Fig. 29A). Zooids rounded-hexagonal in shape (Figs. 29C, 30C), with frontal walls only slightly convex over most of the proximal surface, but raised as a very low peristomial rim around the orifice and around the giant frontal avicularia (Figs. 29B, 30A, B). Frontal wall relatively smooth to slightly granular, imperforate except for a few small round marginal pores. Primary orifice about equal in length and width, with a semicircular anter, two sloping rounded condyles, and a large broadly U-shaped sinus (Fig. 29D). Two kinds of frontal avicularia occur: small triangular, laterally directed avicularia with complete crossbars and a raised hooked rostrum are found near the distal end of the peristome on most zooids (Figs. 29C, D); some zooids also have very large, elongate, sharply pointed avicularia with thickened crossbars, and calcified rostral shelves on swollen cystids. When such giant avicularia are present on a zooid they are placed outside the orifice rim, about level with the proximal end of the orifice, and with the point of the mandible directed proximally to slightly diagonally (e.g., Figs. 30A, B). Ovicells on the holotype specimen were not complete

Figure 27. *Bryopesanser presanseris* (on *Steginoporella magnilabris*). Hassler Box 12. MCZ 1000135. A. Partially broken juvenile colony. Scale bar = 100 μm.

(Fig. 30A), but appeared to be developing as oecial kenozooids as in other *Buffonellaria* species (Berning and Kuklinski 2008; Ostrovsky 2008). The developing oecium rests on the proximal end of the zooid distal to the maternal zooid. When complete it consists of an outer ectooecium with a central window and an inner entooecium. The only complete ovicells were on a second and very abraded specimen, but the thickened proximal lip of the ectooecium around the semicircular opening can be seen (Figs. 30C, D).

Diagnosis. *Buffonellaria* with very enlarged, proximally directed frontal avicularia with sharply pointed tips; small, bluntly triangular oral avicularia; and ovicells with limited exposed entooecium and ectooecium thickened in a lip around the oecial opening.

Measurements

	Range	Mean	*N*
Lz	0.455–0.710	0.560	12
Wz	0.346–0.637	0.472	12
Lo	0.091–0.127	0.108	12
Wo	0.091–0.109	0.101	12
Lov	0.164–0.218	0.193	8
Wov	0.182–0.237	0.214	8
Lav1	0.237–0.328	0.283	11
Wav1	0.091–0.164	0.117	12
Lav2	0.055–0.055	0.055	2
Wav2	0.055–0.055	0.055	2

Notes. This species is very similar in morphology of avicularia and ovicells to *Buffonellaria ritae* Berning and Kuklinski (2008) collected off Santa Cruz, Madeira. However, zooids of the Barbados colonies are larger, the giant avicularia are larger, and also larger relative to zooid size, and have a slightly different position. Complete ovicells in good condition were not present

in the Barbados material, but those from the abraded colony definitely showed the thickened proximal rim surrounding the ovicell opening that is also found in *B. ritae* but not in most other species of the genus.

Distribution. Barbados.

Specimens Examined. MCZ 100138 Hassler Box 2, Barbados, 80 fms. December 1871. MCZ 10137. Hassler Box 15, Barbados, 100 fm. December 1871.

Genus *Buskea* Heller, 1867

Buskea minutiporosa (Canu & Bassler, 1928)

Figure 31

Cellepora tuberosa Smitt, 1873: 52, pl. IX, fig. 180. NOT *Cellepora ramulosa* f. *tuberosa* (d'Orbigny) Smitt, 1868: 31, 191 = *Turbicellipora smitti* (Kluge) 1962.

Cellepora minutiporosa Canu & Bassler, 1928b: 150, pl. 28, fig. 1.

Buskea minutiporosa Winston, 2005: 100, figs. 273–278.

Description. Colonies form bumpy irregular encrustations on calcareous substrata (Fig. 31A). Zooids are large, convex, oval to hexagonal at the growing edge, broad and irregular in shape in frontally budded areas. Frontal wall thickly calcified, smooth textured, with sparse small frontal and larger marginal pores (Figs. 31B, C). The primary orifice, clearly visible only on zooids in the primary layer, has a smoothly calcified rim, a semicircular anterior portion, and a broad, shallow, U-shaped sinus proximally (Fig. 31F). A low thick peristome surrounds it. Its opening has an irregular shape due to its rough calcification and to the common occurrence of one or two oval to bluntly pointed avicularia. The larger more pointed avicularia are embedded at an angle in the proximolateral wall. One or two smaller avicularia may be present on the peristome on one or both sides of the orifice (Figs. 31C, E). Large interzooidal avicularia with broadly spatulate mandibles and a short crossbar are scattered on colony surfaces (Fig. 31D), and small, variously directed avicularia, with rounded mandibles and crossbars, may occur also. The ovicell is large, irregularly rounded, and flattened against the colony surface. It has numerous small pores on its frontal surface and an opening separate from the maternal zooid operculum.

Measurements

	Range	Mean	*N*
Lz	0.510–0.655	0.564	6
Wz	0.364–0.473	0.413	6
Lo	0.127–0.146	0.132	6
Wo	0.109–0.127	0.124	6
Lov	0.218–0.237	0.223	4
Wov	0.218–0.291	0.246	4
Lav	0.109–0.164	0.124	6
Wav	0.055–0.091	0.077	6
Lav2	0.218–0.382	0.294	6
Wav2	0.146–0.255	0.188	6

Notes. This species is easily recognizable because of its large zooids and its flattened, irregular ovicells.

Distribution. Florida, Caribbean.

Specimens Examined. MCZ 100139. Hassler Box 12-4, Barbados, 100 fm. December 1871.

Genus *Cigclisula* Canu & Bassler, 1927

Cigclisula gemmea new species

Figure 32

Holotype. MCZ 100140. Hassler Box 9, Barbados, 100 fm. December 1871.

Etymology. From the Latin adjective, *gemmeus -a -um*, set with jewels.

Description. Colony erect, rigid, with bilaminar branches three or four zooids in width (Figs. 32A, B). Zooids rhombic in outline, flattened to partially erect, frontal wall calcification imperforate and granular to beaded in texture (Fig. 32C). Slitlike marginal pores and a scalloped edge mark the lateral walls of zooids. Primary orifice hoof-shaped, anter slightly more than semicircular, with two smooth bluntly triangular condyles, and a broad (diameter slightly greater than that of anter) shallowly concave poster (Fig. 32D). It lies at the base of a round, smooth-sided peristome, whose outer rim supports four or five rough-textured tubercles. Several small oval avicularia with complete crossbars and raised, toothed rostra are scattered on

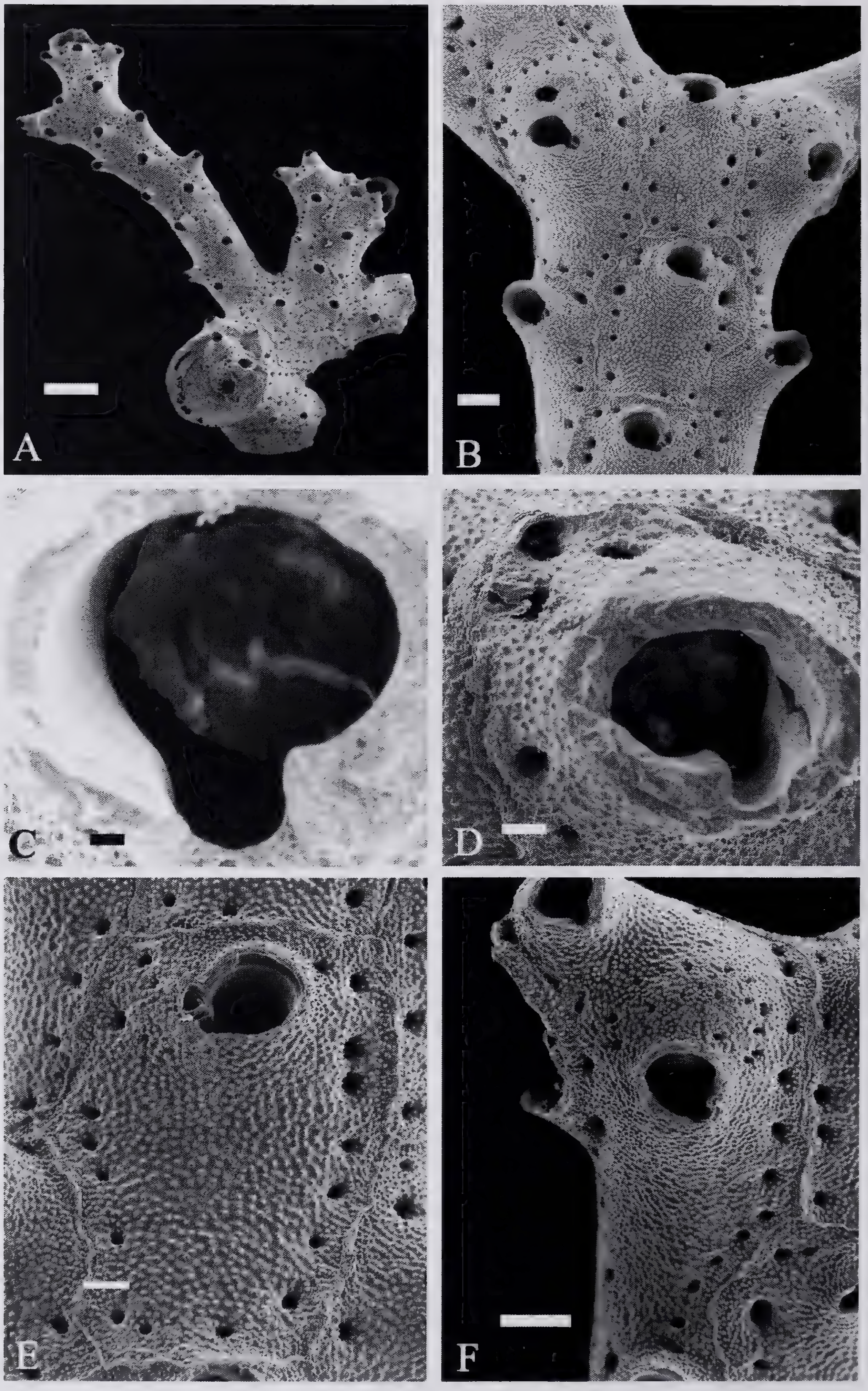

Figure 28. *Gemelliporina hastata*. Hassler Box 8. MCZ 100136. A. Colony branches. Scale bar = 1 mm. B. Portion of branch showing autozooids and one ovicelled zooid (with central pore). Scale bar = 200 μm. C. Partial view of primary orifice inside peristome. Scale bar = 10 μm. D. Zooid peristome. Scale bar = 50 μm. E. Autozooid, showing peristomial avicularium. Scale bar = 100 μm. F. Ovicelled zooid with no central pore. Scale bar = 200 μm.

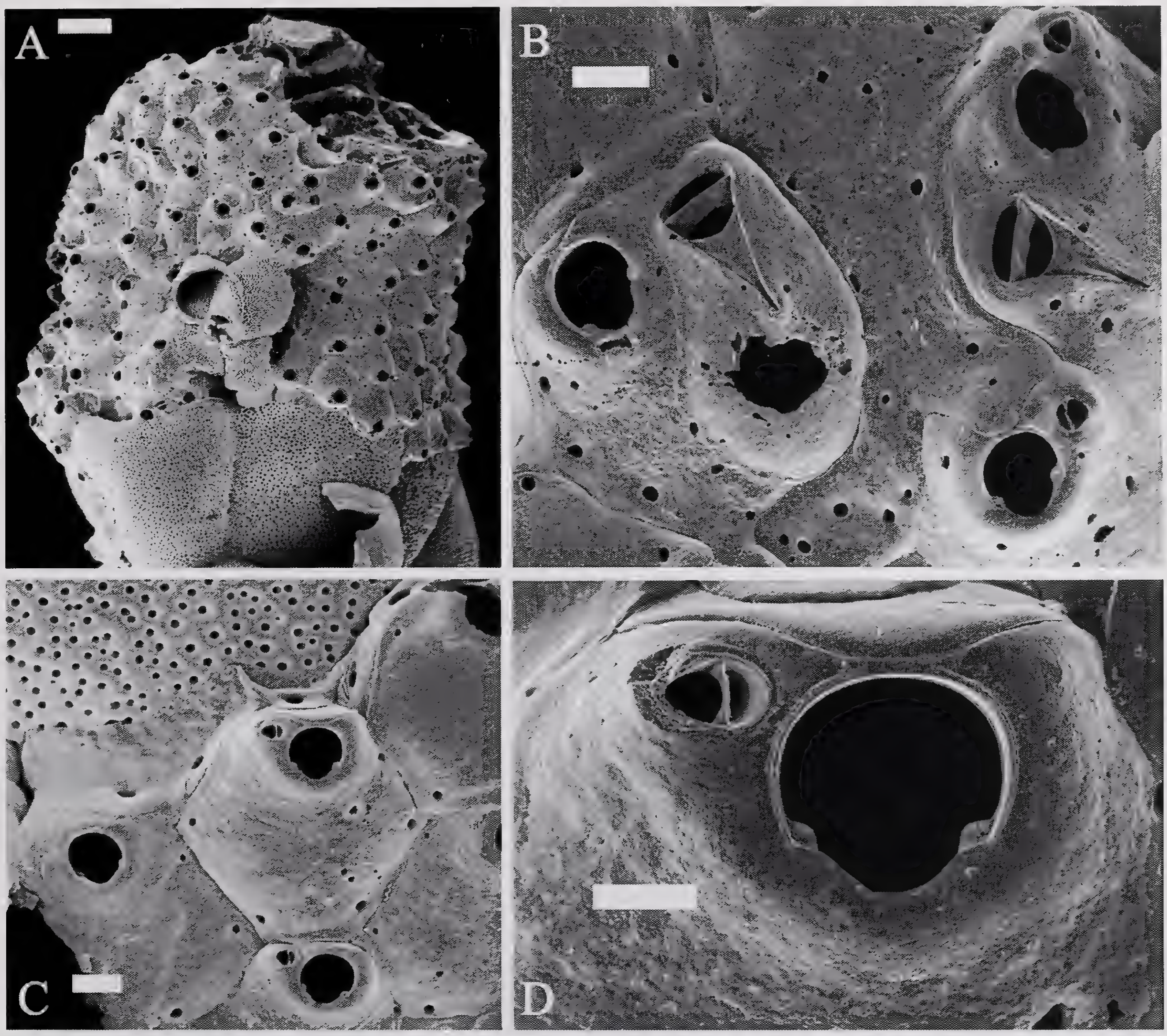

Figure 29. *Buffonellaria ensifera-1*. Hassler Box 15. MCZ 100137. Low magnification view of encrusting colony. Scale bar = 500 µm. B. Autozooids with giant frontal avicularia. Scale bar = 100 µm. C. Zooids with only small avicularia at growing edge of colony. Scale bar = 100 µm. D. Orifice and peristomial avicularium. Scale bar = 50 µm.

the frontal surface, with one of them usually adjacent to a proximally situated orificial tubercle (Fig. 32C). Large spatulate vicarious avicularia of varying sizes, also with complete crossbars and with partly calcified palates, are found on the outer sides of colonies, beyond the zooid rows. Ovicells are covered with the same granular calcification as zooids and may also bear tubercles and small oval avicularia (Fig. 32F). The ovicell has a central U- to V-shaped indentation on its proximal margin and a separate opening not connected with the orifice.

Measurements

	Range	Mean	*N*
Lz	0.601–0.655	0.629	6
Wz	0.510–0.637	0.564	6
Lo	0.155–0.164	0.161	6
Wo	0.127–0.137	0.130	6
Lov	0.273–0.328	0.296	4
Wov	0.255–0.419	0.323	4
Lav1	0.055–0.073	0.062	6
Wav1	0.036–0.055	0.049	6
Lav2	0.291–0.364	0.312	6
Wav2	0.127–0.182	0.161	6

Diagnosis. Erect *Cigclisula* characterized by large interzooecial avicularia on outer edges of branches, very sparse frontal pores, and an ovicell with a shallow sinus.

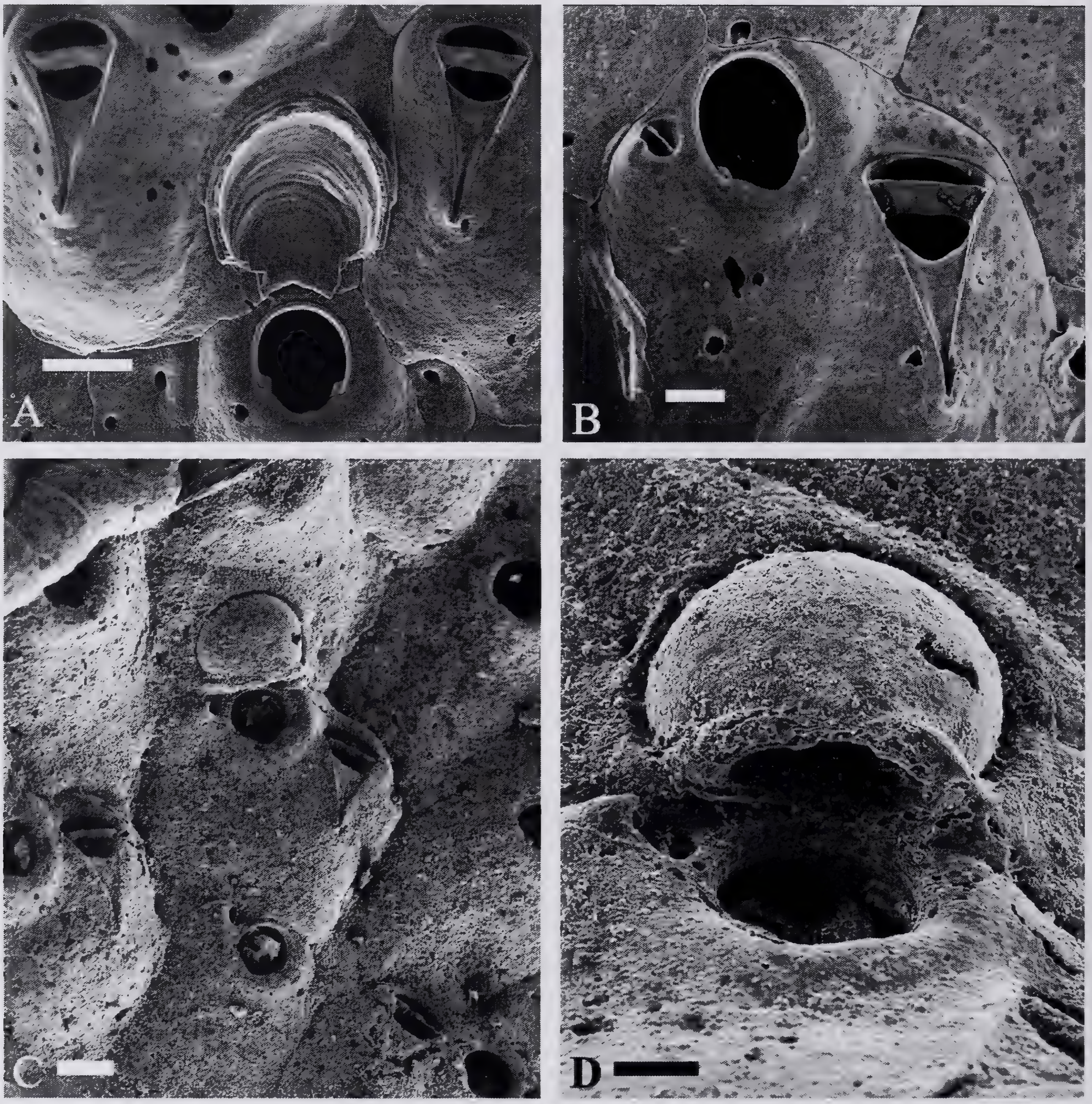

Figure 30. *Buffonellaria ensifera-2.* (A-B Hassler Box 15. MCZ 100137) A. Giant avicularia and developing ovicell. Scale bar = 100 μm. B. An autozooid with both types of avicularia. Scale bar = 50 μm. (C-D Hassler Box 2. MCZ 100138) C. Ovicelled zooid. Scale bar =100 μm. D. Close-up of ovicell. Scale bar = 50 μm.

Notes. This appears to be the first Recent record of the genus in the western Atlantic.

Canu and Bassler (1919) described *Cigclisula porosa* from the Tertiary of the Dominican Republic. All other records are Indo-Pacific.

The family position of this species and related genera such as *Trematooecia* need to be re-evaluated. They do not belong in the Stomachetosellidae, where they have often been placed. The family Stomachetosellidae was based on the genus *Stomatchetosella*, whose type species was an early Tertiary fossil, *Stomachetosella crassicollis* (Canu and Bassler, 1917). However, the Recent species that have been placed in that genus are dissimilar to the fossil type, and the family and genus should not be used for any Recent species until a revision can be done. Tilbrook (2006) placed *Trematooecia* in the family Hippoporidridae, but we have chosen to keep it in the Celleporidae.

Distribution. Barbados.

Specimens Examined. MCZ 100140. Hassler Box 9, Barbados, 100 fm. December 1871.

Genus *Trematooecia* Osburn, 1940

Trematooecia turrita (Smitt, 1873)

Figure 33

Lepralia turrita Smitt, 1873: 65, pl. XI, figs. 226–228.

Holoporella turrita. Canu & Bassler, 1923: 179, pl. 46, fig. 1; 1928b: 145, text-figs. 33c, d.

NOT *Trematooecia turrita* (Smitt) Osburn, 1914: 217; 1940: 458 (= *Trematooecia aviculifera*)
Cigclisula turrita Winston, 1982: 147, fig. 79.
Trematooecia turrita Winston, 2005: 105, figs. 291–297.

Description. Colonies forming one or more layers, encrusting to nodular (Fig. 33A). Zooids erect, their depth often greater than their frontal length or width, with irregularly polygonal borders. The primary orifice is subcircular proximally and almost circular distally with triangular distolaterally pointing condyles. It is located in the center of the frontal surface and surrounded by a peristome of four or five long, flat-tipped tubercles (Fig. 33B). Frontal calcification is thick and somewhat granular, particularly around the orifice, with small pores scattered over the surface. Small oval avicularia with serrated distal rostral margins are embedded at an angle in peristome walls between or near the ends of tubercles. Larger frontal avicularia with an enlarged, spatulate mandible and smooth rostrum also occur. Ovicells open into the peristome and are detectable only as a grid of small pores adjacent to some of the orifices.

Measurements

	Range	Mean	*N*
Lz	0.619–0.855	0.770	6
Wz	0.564–0.783	0.676	6
Lo	0.218–0.255	0.238	6
Wo	0.255–0.309	0.268	6
Lav1	0.109–0.146	0.122	5
Wav1	0.073–0.109	0.091	5
Lav2	0.346–0.346	0.346	1
Wav2	0.237–0.237	0.237	1

Notes. Nomenclature is discussed in Winston (2005), p. 107. As with many bryozoan "species" this may actually be a species group, as some morphological differences occur between specimens from different areas of the Caribbean.

Distribution. Florida, Caribbean.

Specimens Examined. MCZ 100141. Hassler Box 1-2, Barbados, 80 fm. December 1871.

Family Phidoloporidae Gabb & Horn, 1862

Genus *Rhynchozoon* Hincks, 1895

Rhynchozoon sexaspinatum new species

Figure 34

Holotype. MCZ no. 100142. Hassler Box1-1, Barbados, 80 fm. December 1871.

Etymology. From the Latin *sex*, six, and *spina -ae* f., a thorn.

Description. Colony encrusting in one or more layers (Fig. 34A). Frontal surface rough textured and chaotic because of its numerous tubercles and avicularia. Zooids oval to irregular in outline, calcification thick and imperforate with sunken, variously sized marginal pores marking their boundaries (Figs. 34B–E). Primary orifice is keyhole-shaped, with a rounded anter with beaded lateral and distal rims, very large sunken condyles, and a large rounded sinus (Fig. 34F). The distal rims of young zooids show six hollow spines (Fig. 34F). As calcification proceeds the spines become immersed, with four, two, or none visible as tuberculate peristomes develop around the primary orifice. The thick peristome has one large proximal, slightly off-centered conical tubercle with a small vertical avicularium on its inner side. On smaller raised conical projections on either side of the orifice may be tubercles with or without diagonally raised oval avicularia with crossbars and serrate rostra. Some of the frontal avicularia are enlarged, either as elongate bluntly pointed spoon shapes or broad triangular shapes (Fig. 34C) The spoon-shaped avicularia have a sunken rostral shelf and raised rims but are not raised diagonally. The broad triangular avicularia are raised at an angle on large tubercles. Ovicells are semicircular and immersed in frontal wall calcification, some with central conical

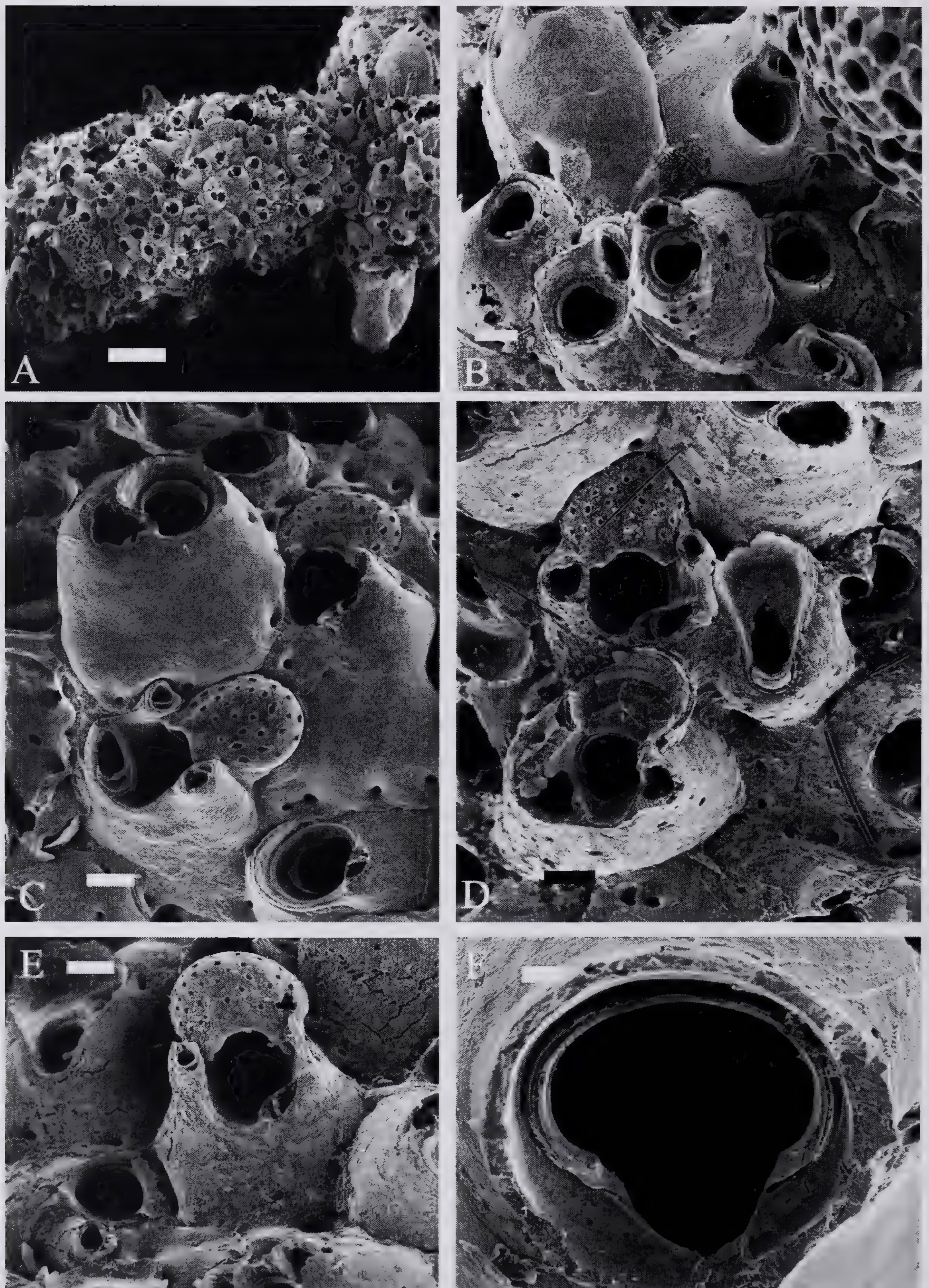

Figure 31. *Buskea minutiporosa*. Hassler Box 12-4. MCZ 100139. A. Low-magnification view of encrusting colony. Scale bar = 1 mm. B. Autozooids near edge of colony. Scale bar = 100 μm. C. Group of autozooids and ovicelled zooids with peristomial avicularia of different sizes. Scale bar = 100 μm. D. Group of zooids with a spatulate interzooecial avicularium. Scale bar = 100 μm. E. Flattened ovicell, and raised avicularia. Scale bar = 100 μm. F. Close-up of primary orifice. Scale bar = 20 μm.

tubercles topping them (Fig. 34D), their opening in the peristome above and perpendicular to the sunken zooid orifice. The vertical semicircular wall of the ovicell has a smoother texture and a curved labellum.

Diagnosis. *Rhynchozoon* with an orifice showing a very round poster and very large condyles, as well as six obvious oral spines on young zooids, rough papillate frontal walls, embedded ovicells, and three distinct types of avicularia. It may be distinguished from other Caribbean species by its orifice shape, particularly the enlarged condyles and rounded poster. *Rhynchozoon spicatum* Osburn, 1952, has an orifice with a very large shallow sinus, small tabs of condyles, and sparse beading around distal rim of anter, whereas *Rhynchozoon verruculatum* (Smitt) 1873 has a U-shaped sinus of moderate width.

Measurements

	Range	Mean	*N*
Lz	0.346–0.437	0.388	6
Wz	0.328–0.455	0.373	6
Lo	0.118–0.146	0.132	6
Wo	0.073–0.109	0.093	6
Lov	0.146–0.182	0.167	3
Wov	0.182–0.209	0.197	3
Lav1	0.055–0.091	0.071	6
Wav1	0.046–0.073	0.056	6
Lav2	0.237–0.528	0.337	6
Wav2	0.091–0.127	0.112	6

Distribution. Barbados.

Specimens Examined. MCZ 100142. Hassler Box 1-1, Barbados, 80 fm. December 1871.

Genus *Stephanollona* Duvergier, 1920

Stephanollona propinqua new species

Figures 35, 36

Holotype. MCZ 00143. Hassler Box 14, Barbados, 100 fm. December 1871.

Etymology. From the Latin *propinquus -a -um* =near, neighboring; similar; nearly related, closely connected.

Description. Colony encrusting in one or more layers, with a rugose surface texture due to its thick calcification and protruding avicularia (Figs. 35A–C). Zooids oval to irregularly polygonal, frontal surface covered by rough wavy ridges and bumps of calcification bounded by sunken marginal pores, junction of lateral walls a thin, barely detectable line (Fig. 35F). Orifice with six to eight hollow spines, a semicircular anter with a beaded rim, condyles with two rounded bumps, and a wide and very shallow sinus (Fig. 35E). Two types of avicularia occur. Small paired or single oval avicularia with complete crossbar, short columella, and a toothed rostrum tip occur on the frontal surface well away from the orifice (Fig. 36D). They may be positioned beside or below the orifice. There may be a second pair near the proximal edge of the zooids (e.g., Fig. 35C). These are raised diagonally from the colony surface and directed laterally to proximolaterally. Larger elongate elliptical avicularia with large mandibles and crossbars with a larger columella are scattered on the surface of the colony (Fig. 36C). Ovicells with ectooecium covered by same wavy granular calcification as zooid frontal walls, semicircular in shape, and tilted almost perpendicular to the zooid orifice. A smaller semicircular window of entooecium is visible, membranous at first, then becoming calcified (Figs. 35C, 36A, B). Ovicell opening is separate from zooid operculum.

Diagnosis. *Stephanollona* with six to eight oral spines, single or doubled pairs of oval frontal avicularia, and occasional enlarged elongate avicularia. Can be distinguished from the most similar species, *Stephanollona asper* (Canu and Bassler) 1923 by the morphology of the orifice, the presence of one to two more spines on some zooids, and by the presence of additional oval avicularia.

Measurements

	Range	Mean	*N*
Lz	0.437–0.655	0.531	6
Wz	0.473–0.601	0.537	6
Lo	0.118–0.137	0.127	6
Wo	0.109–0.127	0.117	6
Lov	0.200–0.237	0.226	5
Wov	0.255–0.273	0.266	5
Lav	0.237–0.364	0.291	6
Wav	0.109–0.127	0.121	6
Lav2	0.091–0.146	0.109	6
Wav2	0.073–0.109	0.088	6

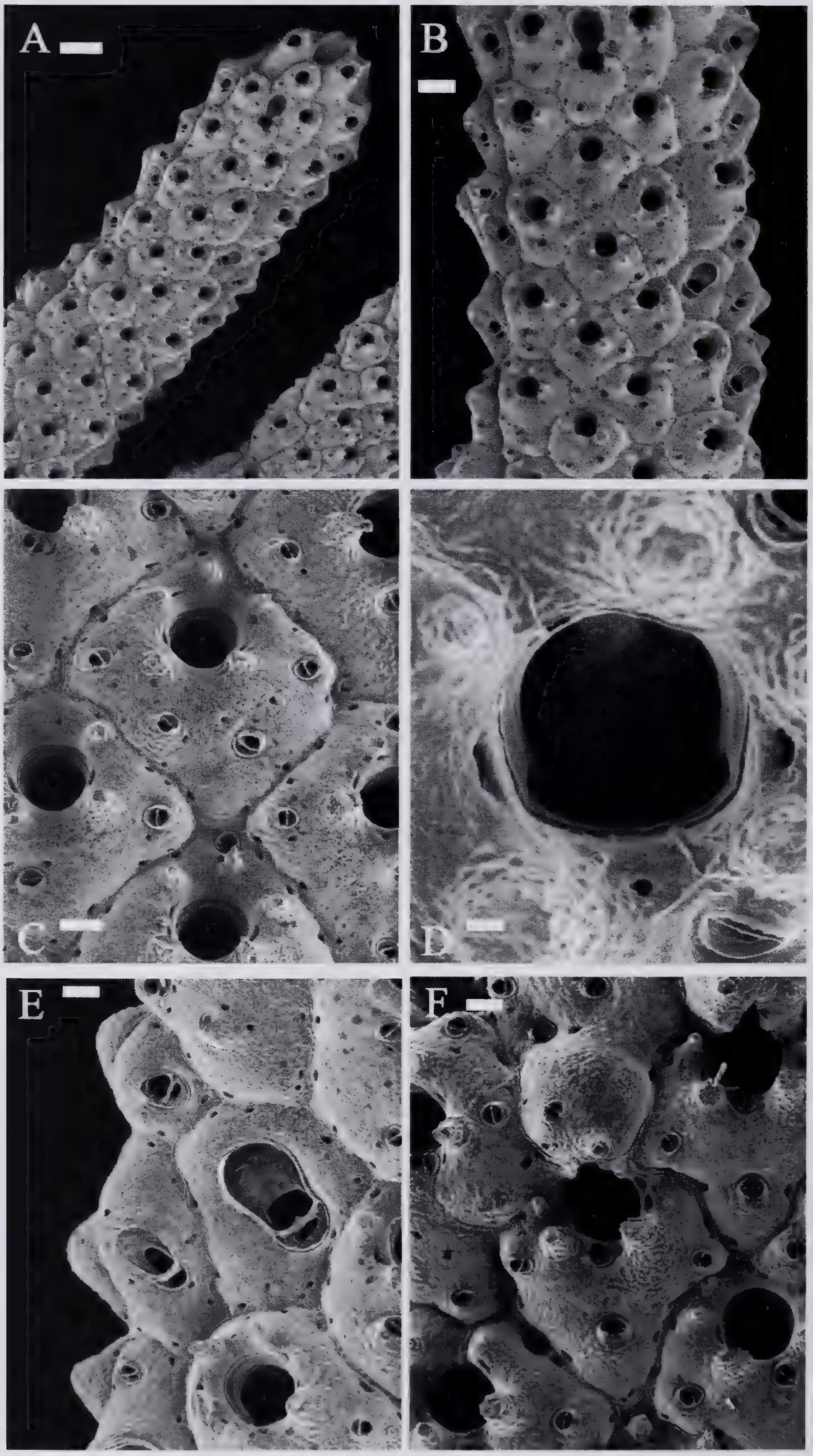

Figure 32. *Cigclisula gemmea.* Hassler Box 9. MCZ 100140. A. Low-magnification view of branches of erect colony. Scale bar = 500 μm. B. Portion of a single branch. Scale bar = 250 μm. C. Group of autozooids showing scattered avicularia. Scale bar = 100 μm. D. Close-up of primary orifice. Scale bar = 25 μm. E. Edge of branch showing interzooecial avicularia. Scale bar = 100 μm. F. Two ovicelled zooids. Scale bar = 100 μm.

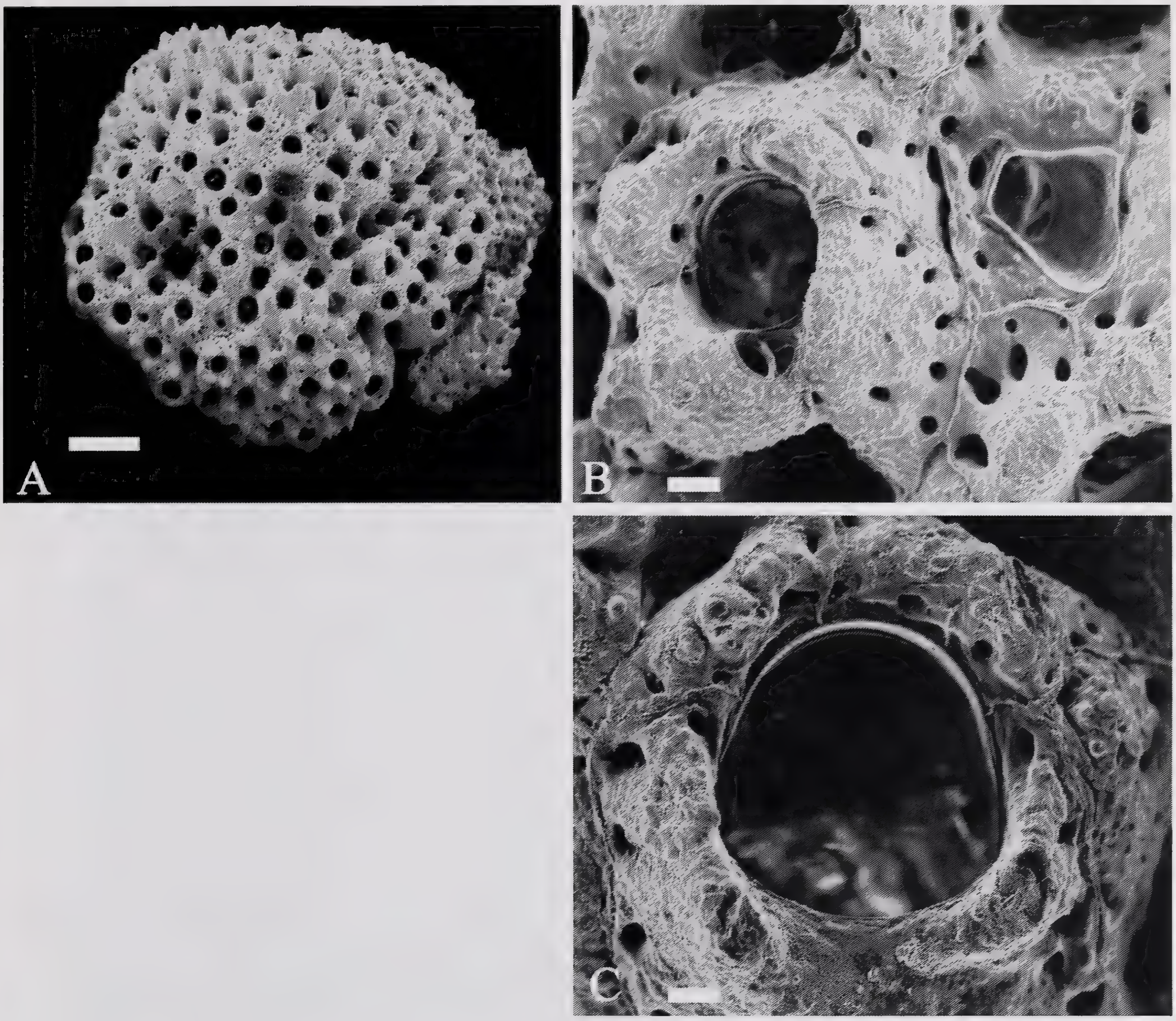

Figure 33. *Trematooecia turrita*. Box 1-2. MCZ 100141. A. Whole nodular colony. Scale bar = 1 mm. B. Zooid with peristomial avicularium and adjacent spatulate interzooecial avicularium. Scale bar = 100 μm. C. Close-up of orifice. Scale bar = 50 μm.

Notes. This appears to be a sister species to *S. asper*, a common Caribbean species. It is morphologically very similar except for the much broader and shallower sinus of the orifice, and in its more semicircular anter and double projecting condyles. As more material from the greater Caribbean is studied, a gradient in morphology between the Barbados material and *S. asper* may be found, but since orifice shape is one of the most strongly constrained characters in bryozoan species, we chose to describe it here as a separate species.

Distribution. Barbados.

Specimens Examined. MCZ 100143. Hassler Box 14, Barbados, 100 fm. December 1871.

Genus *Reteporellina* Harmer, 1933

Reteporellina directa new species

Figures 37, 38

Holotype. MCZ 100144. Hassler, Box 13. Barbados, 100 fm. December 1871.

Etymology. From the Latin *directus*, straight.

Description. Colony made up of erect, unjointed, bifurcating, nonreticulate branches (Figs. 37A, B) attached by a cemented base. Zooids irregularly rhomboidal, their frontal walls of smooth-to-wavy calcification with only a few small marginal pores visible and with raised suture lines marking zooid boundaries (Figs. 38A, C).

The primary orifice, which can be seen only on developing zooids at the growing tip of branches, has no oral spines, and is transversely elliptical, with small rounded condyles (Fig. 37D). Zooids rapidly develop long tubular peristomes with a central U-shaped sinus. The free ends of the peristome become elaborated into calcareous ruffles and projections as zooids age, but the small central sinus remains apparent. On the frontal wall of many zooids are large raised spatulate avicularia, with bifid hooked rostra (Figs. 38A, B, D). These avicularia are directed proximally, parallel to the branch axis. Ovicells smoothly calcified, flattened helmet shaped, with an elongate median fissure and a scalloped labellum (Figs. 38A, D). Abfrontal colony surface marked by raised sutures (Fig. 37C).

Diagnosis. *Reteporellina* with a transversely elliptical orifice with small rounded condyles, narrow branches, ruffled peristomes, and large proximally directed frontal avicularia with bifid rostra. No avicularia present on abfrontal surfaces. Ovicells with a long central slit and a short, scalloped labellum. It can be distinguished from other Caribbean species by its primary orifice. *Reteporellina evelinae* Marcus, 1955 has an orifice with semicircular anter and very shallow sinus, and *Reteporellina marsupiata* (Smitt) 1873 has an orifice with a keyhole-shaped sinus.

Measurements

	Range	Mean	*N*
Lz	0.564–0.673	0.628	6
Wz	0.200–0.309	0.258	6
Lo	0.109–0.146	0.120	6
Wo	0.127–0.191	0.173	6
Lov	0.200–0.237	0.224	6
Wov	0.164–0.200	0.187	6
Lav	0.182–0.237	0.217	6
Wav	0.127–0.155	0.138	6

Notes. This species is very similar to both *R. marsupiata* (Smitt) 1873 and *R. evelinae* Marcus, 1955, in morphology of the large frontal avicularia. However, in both species the frontal avicularia are directed at an angle, proximolaterally rather than proximally. The flared and ruffled peristome is very similar to that of *R. evelinae*.

Distribution. Barbados.

Specimens Examined. MCZ 100144. Hassler Box 13, Barbados, 100 fm. December 1871.

DISCUSSION

There are no published taxonomic accounts of the bryozoans of Barbados. Lewis (1960) described 33 scleractinian coral species on living reefs on the west side of Barbados, but, although the occurrence of bryozoans in the shallow coral reef community was mentioned, they were not discussed further, nor do they appear in the taxonomic lists in his subsequent work (Lewis, 1965) on deeper-water (50–400 m) Barbados benthic communities. From later studies of Caribbean reefs we know that bryozoans are important components of cryptic reef communities in the region (Winston, 1984, 1986; Winston and Jackson, 1984) and from taxonomic monographs on the bryozoan fauna of the Gulf of Mexico and Caribbean we know that they can also be abundant in tropical shelf and slope habitats (Canu and Bassler, 1928a,b; Osburn 1947; Rucker, 1967; Smitt, 1872, 1873).

The only published list of species of bryozoans from Barbados occurs in a paper on calcified epibionts as paleoecological tools (Martindale, 1992). Martindale states that the encrusting bryozoan fauna of Recent Barbados reefs includes at least 24 species. His survey of natural and artificial habitats from shore to 50 m found most bryozoans to occur between 10 and 30 m in cryptic (shaded) habitats. He lists 18 species, identified by bryozoan taxonomist P. L. Cook of the Natural History Museum, London, and illustrates four: *Steginoporella magnilabris*, *Parellisina latirostris*, *Puellina radiata*, and *Lichenopora* (= *Patinella*) sp.

From the Martindale species list, limited as it is, it is clear that in terms of genera, and to a large extent species, the shallow-reef bryozoan fauna of Barbados are similar to those of other shallow Caribbean reef areas

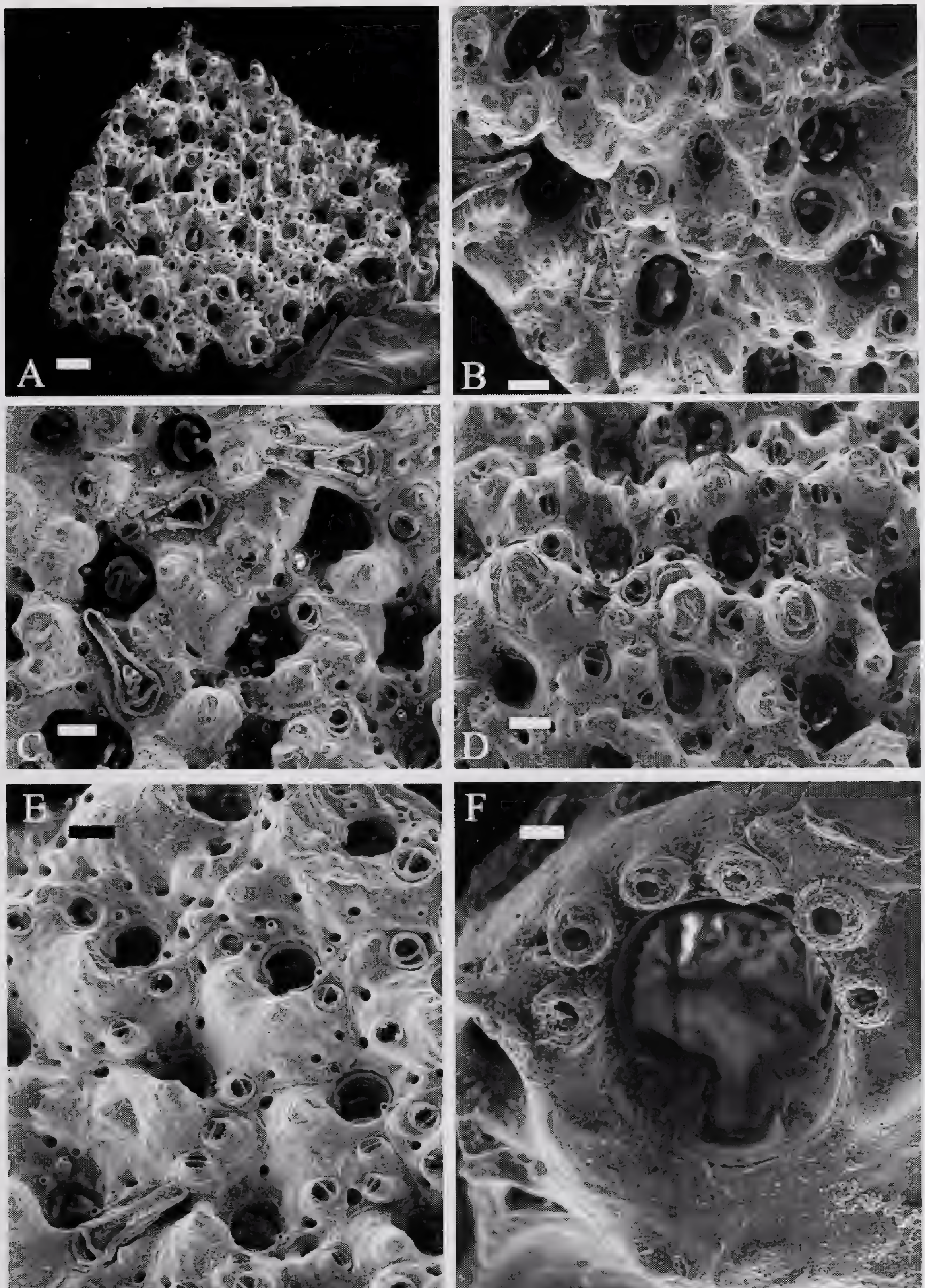

Figure 34. *Rhynchozoon sexaspinatum*. Hassler Box 1-1. MCZ 100142. A. Low-magnification view of encrusting colony fragment. Scale bar = 250 μm. B. View of frontally budded zooids, showing various types of avicularia. Ovicell on center-left zooid. Scale bar = 100 μm. C. Another region of colony with ovicelled zooids and heavy tubercles. On each zooid one conical tubercle adjacent to the orifice bears a vertically positioned avicularium on its inner side. Scale bar = 100 μm. D. Highly tuberculate and aviculiferous colony surface. Scale bar = 100 μm. E. Zooids near growing edge on which tubercles have not completely developed and primary orifice can be seen. Some oral spines still visible. Scale bar = 100 μm. F. Primary orifice showing shape of sinus, beaded distal rim, and six hollow spines. Scale bar = 25 μm.

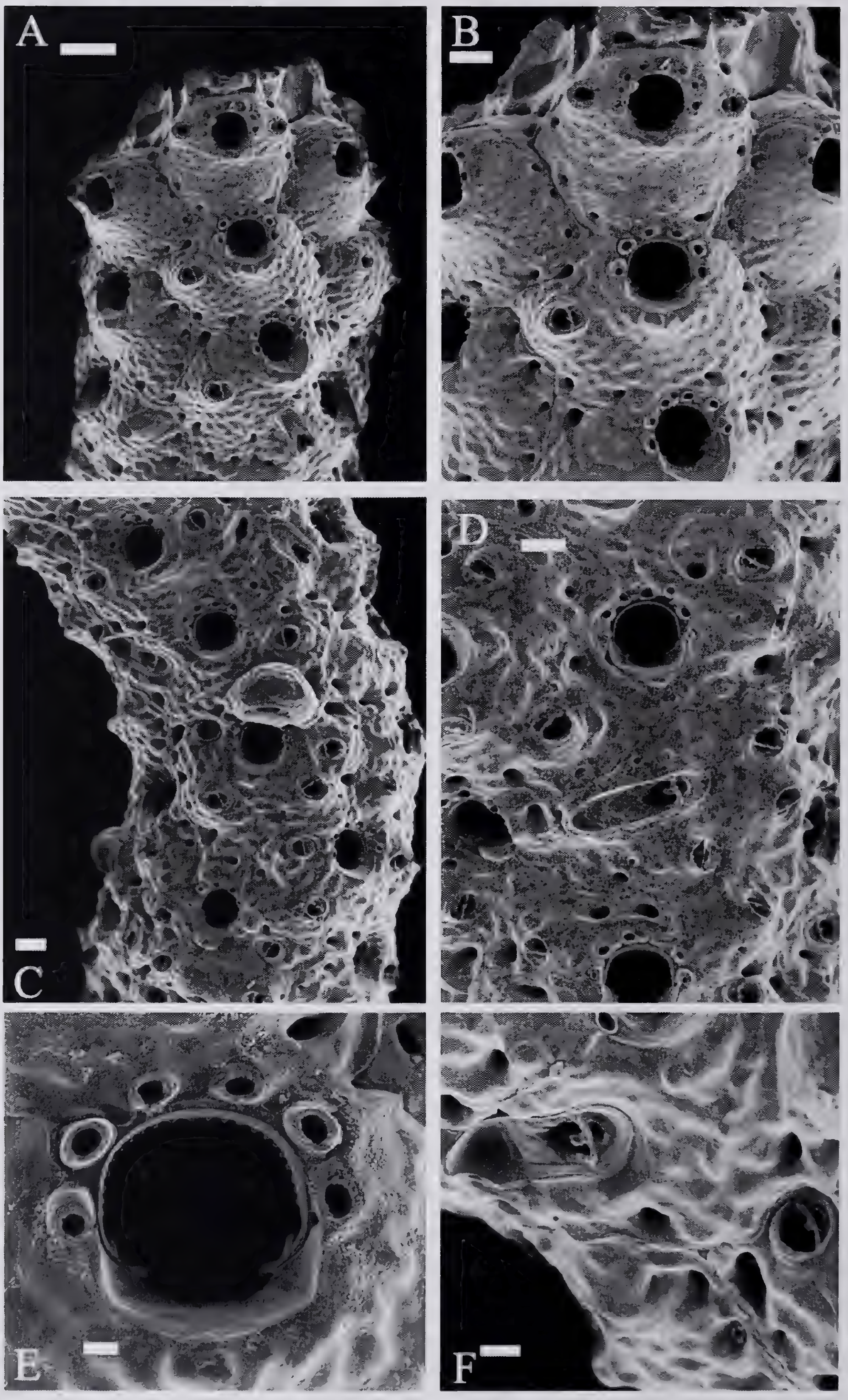

Figure 35. *Stephanollona propinqua-1*. Hassler Box 14. MCZ 100143. A. Growing tip of colony encrusting a tubular substratum. Scale bar = 200 μm. B. Zooids at growing edge, showing oral spines and early avicularian development. Scale bar = 100 μm. C. Portion of colony showing ovicelled zooid with double pairs of avicularia. Scale bar = 100 μm. D. Area of colony with many small avicularia and one larger elongate oval avicularium. Scale bar = 100 μm. E. Close-up of an orifice with six spines; note beaded rim, and double-ended condyles. Scale bar = 25 μm. F. Large avicularium with bent and pointed rostrum and small, almost round, avicularium. Scale bar = 50 μm.

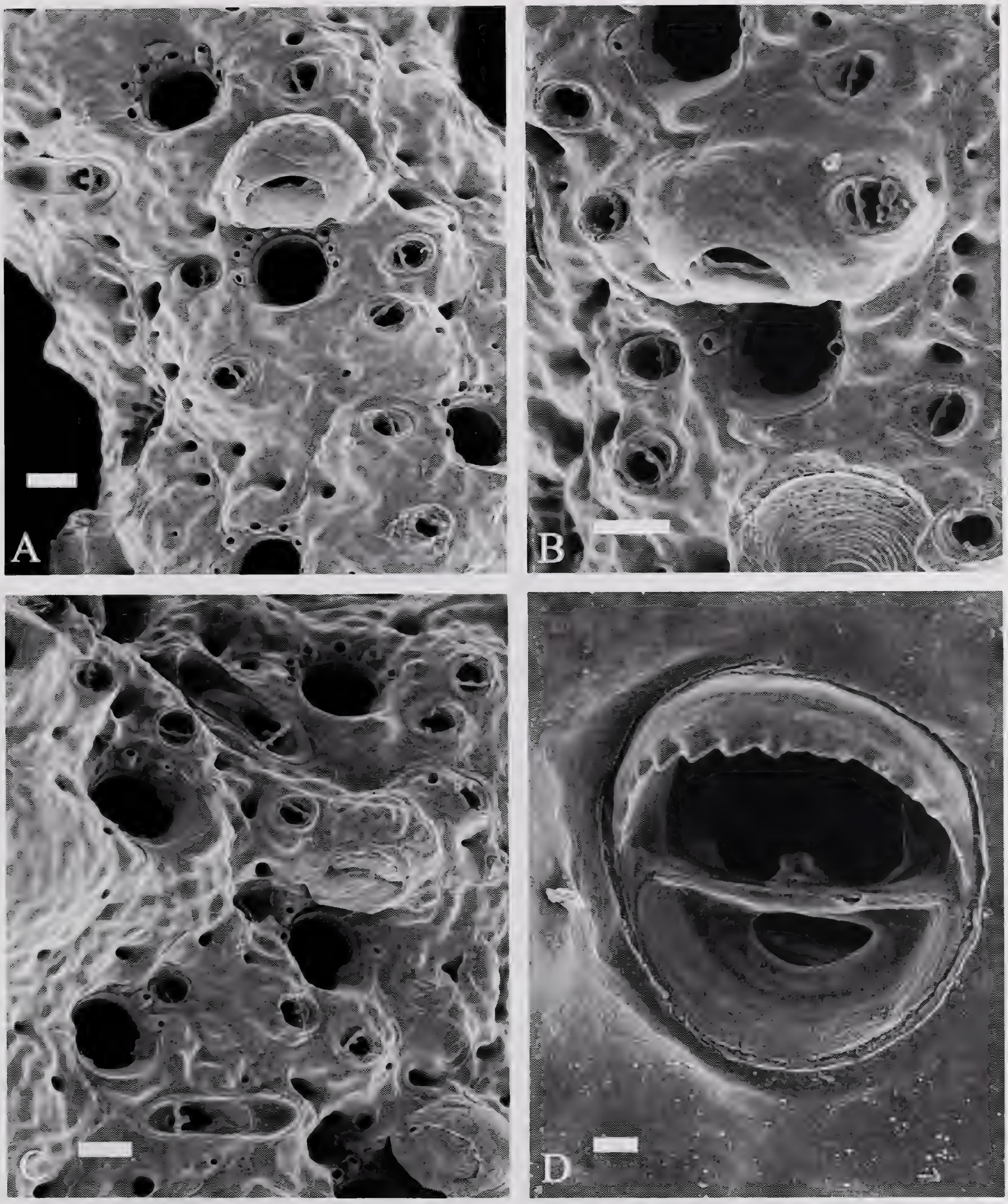

Figure 36. *Stephanollona propinqua-2*. A. Another view of ovicell. Note additional spines. Scale bar = 100 μm. B. Ovicell that has incorporated a pair of avicularia. Scale bar = 100 μm. C. Another view of colony surface and ovicells. Scale bar = 100 μm. D. Close-up of small avicularium. Note serrated rostrum and bifid projection on crossbar. Scale bar = 10 μm.

that have been studied, including Belize, Jamaica, Panama, Puerto Rico, and Costa Rica.

Macintyre et al. (1991) described a deep relict reef off the west coast of Barbados. Although their transect was north of where the two Hassler samples were collected, the topography they describe below the reef itself at 100+ m, a steep rubble and sand slope with exposed patches of epifauna-

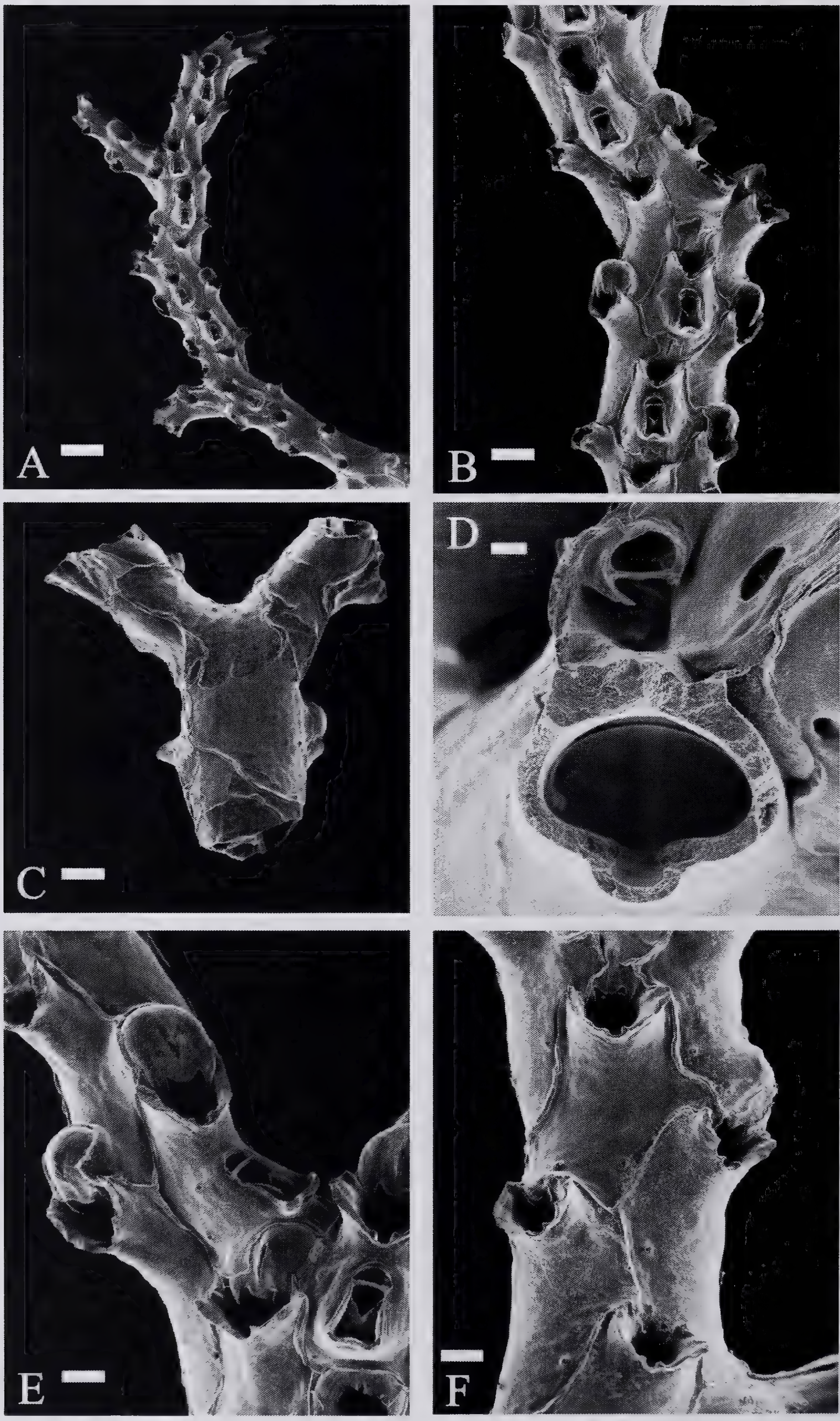

Figure 37. *Reteporellina directa-1.* Hassler Box 13. MCZ 100144. A. Colony branches. Scale bar = 500 μm. B. Close-up of branch, showing zooid morphology and position and orientation of avicularia. Scale bar = 200 μm. C. Back view of branch at a bifurcaton. Scale bar = 200 μm. D. Partial view of primary orifice. Scale bar = 20 μm. E. Ovicelled zooids at a branch bifurcation. Scale bar = 100 μm. F. Zooids without avicularia; two with ovicells. Scale bar = 100 μm.

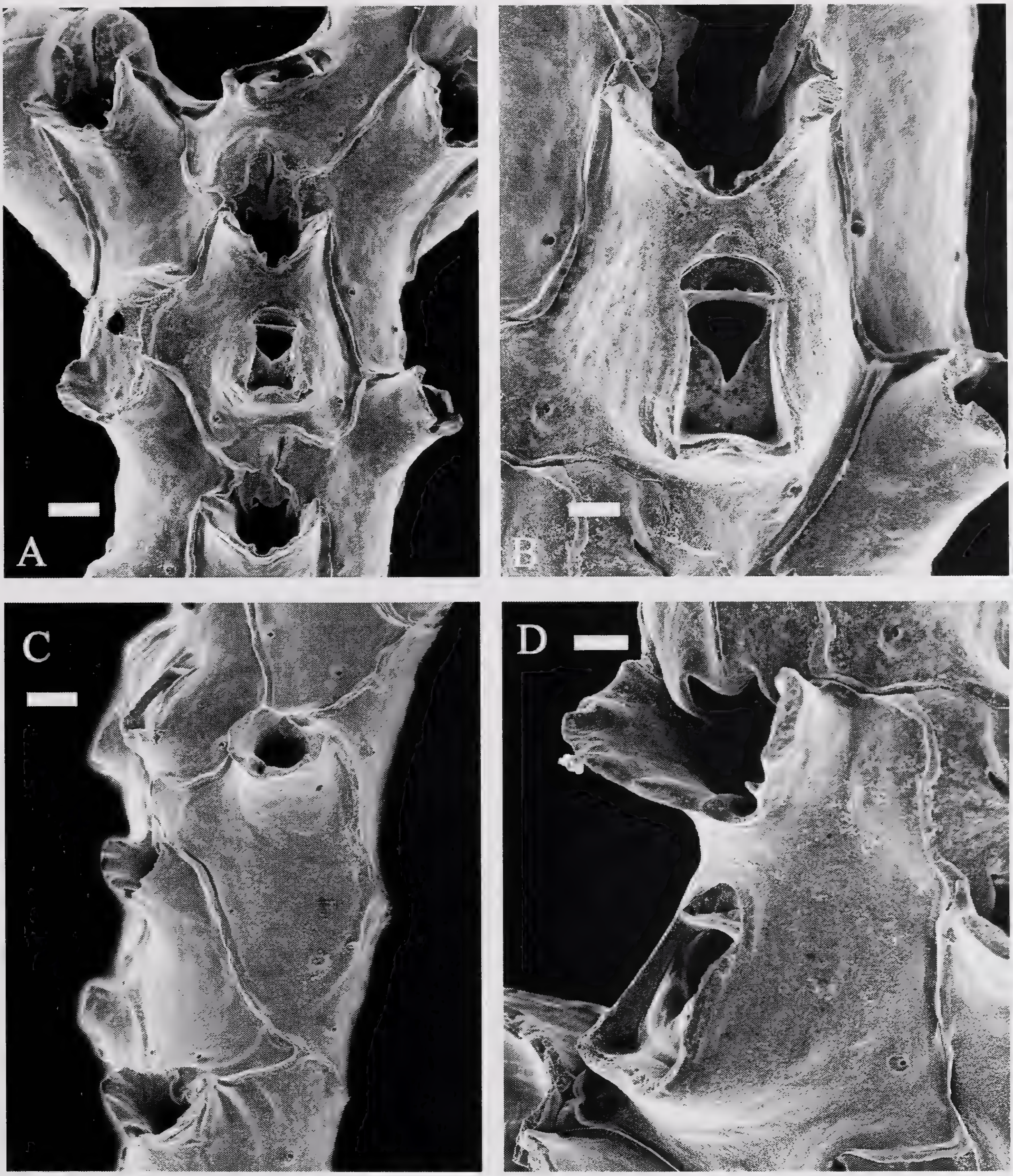

Figure 38. *Reteporellina directa-2*. A. Zooids with ovicells. Scale bar =100 μm. B. Close-up of an avicularium. Scale bar = 50 μm. C. Side view of branch segment to show ruffled peristome. Scale bar = 100 μm. D. Single ovicelled avicularium-bearing zooid in side view. Scale bar = 50 μm.

covered hardground, is consistent with the bryozoan growth forms and substrata collected by *Hassler* in 146–184 m. Macintyre's sediment sample of the 80-m ridge top of the relict reef contained irregular, heavily bored algal nodules, encrusted by calcareous epibionts including bryozoans. Similar slope algal nodules have been reported from eastern Caribbean island margins, including Barbados, by Reid and Macintyre (1988) and Stentoft (1994). Some of the species described in this paper occurred on such a

nodule. Stentoft also described the slope facies down to about 140 m as "rich in mollusc fragments and bryozoans". From 140 to 215 m he listed sediments as "rich in foraminifera, molluscs and crustaceans", with no mention of bryozoans, yet the *Hassler* sample from 100 fm (184 m) contained 16 species, almost as many as found at the 146 m site (19).

The most striking thing about the *Hassler* Barbados bryozoan collection is the large number of new species relative to the total number of species found at the two stations sampled. Of 26 cheilostome species found, 16 are new, and one represents a new genus, *Barbadiopsis.* Even subtracting the two new species that had been previously recorded in the region, but misnamed (*Exochella tropica* and *Metroperiella agassizi*), more than 50% of the cheilostome species are new. In part, this may be due to the lack of sampling of deeper-water habitats in the eastern Caribbean. The taxonomic reports of bryozoans of the region are almost all from shallow reef or mangrove habitats. Osburn (1927) recorded 23 bryozoans collected from two shallow inland bays in Curaçao. Leaving out the "species" we now recognize as species groups and for which species determination would require study of his specimens, only two species were in common with *Hassler*'s Barbados samples: *Bryopesanser pesanseris* and *Trematooecia turrita*. Fransen (1986) described 25 species from Curaçao, mostly also from shallow bays. Not surprisingly, there was no overlap with the Barbados material.

Studies in which deeper water sampling did occur also show little overlap. Osburn (1947) listed 107 species taken during the Allan Hancock Atlantic Expedition, 1939, at coastal and continental shelf stations (deepest 130 m) from Panama eastward to Colombia and Venezuela. Only four species from this collection were also found in the Barbados collection: *Proboscina robusta*, *Steginoporella magnilabris*, *Lagenipora verrucosa*, and *Bryopesanser pesanseris*. Flórez-Romero et al. (2007) reported 62 species of cheilostome bryozoans collected by trawling from soft bottoms of the Colombian Caribbean at depths from 20 to 500 m. Four species were also found in Barbados: *Steginoporella magnilabris*, *Trematooecia turrita*, *Bryopesanser pesanseris*, and *Microporella protea*.

Rucker (1967) listed 42 cheilostome species from cores taken on transects across the mostly soft bottom sediments of Venezuela–British Guiana continental shelf, of which only three species were also found in Barbados: *Antropora typica*, *Steginoporella magnilabris*, and *Bryopesanser pesanseris*.

The lack of similarity in the bryozoan fauna may be related to the isolated position of Barbados, more than 145 km east of the other Lesser Antilles Islands and subject to different recruitment-affecting current patterns than other areas studied. Richardson and Cowen (2004) studied the diversity of leptocephalus fish larvae around Barbados with sampling extending to 140-m depth. They found the source of recruits to be linked to oceanographic conditions. At times when North Brazil Current Rings (anticyclonic rings formed by the collision of the North Brazil Current and the North Equatorial Countercurrent and extending to 200-m depth) reached the waters around Barbados, the abundance of locally spawned larvae was reduced and an increase in species, probably carried from the Guyanas region of the South American coast (between the Orinoco and Amazon Rivers), increased. At other times recruitment from local spawning events predominated.

Other groups of organisms are also more speciose in deep water in the Lesser Antilles area. According to Macintyre et al. (1991) the deeper-water (80 m) Barbados algal fauna may be diverse, and both stylasterines and ahermatypic corals show their greatest Caribbean diversity in the Lesser Antilles and at depths below 100 m. This diversity in deeper water might also be explained by the effects of the Holocene transgression. Beginning some time after 9,000 years ago, increasing sea levels drowned once-shallow coral reefs in the Caribbean and off the

Florida east coast (Macintyre et al., 1991). The flooding, bringing with it cooler water, turbidity, and higher nutrient levels, could also have isolated once-reef-associated species in deeper water where the survivors, now removed from other reef habitats, diverged from their relatives.

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A Revised Phylogenetic Analysis for the Spider Genus *Clitaetra* Simon, 1889 (Araneae, Araneoidea, Nephilidae) with the First Description of the Male of the Sri Lankan Species *Clitaetra thisbe* Simon, 1903

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A REVISED PHYLOGENETIC ANALYSIS FOR THE SPIDER GENUS *CLITAETRA* SIMON, 1889 (ARANEAE, ARANEOIDEA, NEPHILIDAE) WITH THE FIRST DESCRIPTION OF THE MALE OF THE SRI LANKAN SPECIES *CLITAETRA THISBE* SIMON, 1903

DIMITAR DIMITROV,[1,4] SURESH P. BENJAMIN,[2] AND GUSTAVO HORMIGA[3]

ABSTRACT. In this study, we describe the previously unknown male of the spider *Clitaetra thisbe* Simon, 1903, from Sri Lanka and provide some data on its natural history. In light of this new information, we present results from the first cladistic analyses of *Clitaetra* species that include male morphological characters of *C. thisbe* and DNA sequence data for representatives of all nephilid genera and a broad sample of outgroups. The monophyly of *Clitaetra* and the basal position of *C. thisbe* within the genus are corroborated. Our results also support the hypothesis that *Nephila* is a sister group to the clade *Herennia* + *Nephilengys*, which challenges the current hypothesis for nephilid relationships that has been used extensively for the study of genitalic and web evolution in Nephilidae. We also discuss some of the previously proposed interpretations and primary homology statements for several male genitalic characters in nephilids.

INTRODUCTION

Nephilids are orb-weaving spiders that inhabit the tropical and subtropical regions of the world. *Nephila* Leach, 1815, species are probably among the most conspicuous spiders in these geographical areas in that females can reach up to about 4 cm body length and their webs often exceed 1 m in diameter (Harvey et al., 2007; Jocqué and Dippenaar-Schoeman, 2006; Robinson and Robinson, 1973). The first cladistic studies that included *Nephila* and its relatives placed this araneoid lineage as sister to a clade comprising all other tetragnathids and treated it as a subfamily within Tetragnathidae (Coddington 1990; Griswold et al., 1998; Hormiga et al., 1995). A recent revisionary study elevated the group containing the genera *Nephila; Herennia* Thorell, 1877; *Nephilengys* L. Koch, 1872; and *Clitaetra* to family rank and refuted the placement of nephilids as a tetragnathid lineage (Kuntner, 2006; see also Kuntner et al., 2008). More recently, in a study that featured a multilocus molecular dataset combined with morphological evidence, Álvarez-Padilla et al. (2009) also found that nephilids do not represent a tetragnathid lineage. Kuntner (2006) also revised and phylogenetically tested the monophyly and the relationships of *Clitaetra* and demonstrated that the genera *Deliochus* Simon, 1894, and *Phonognatha* Simon, 1894, do not belong within Nephilidae. The latter two genera were formally transferred to the family Araneidae by Kuntner et al. (2008).

Kuntner's (2006) revision of *Clitaetra* represents the most comprehensive study of this genus to date. One of the findings of his revision is the basal phylogenetic position of the Sri Lankan species *Clitaetra thisbe* as sister to a clade that includes the remaining species in the genus. This hypothesis makes *C. thisbe* (Fig. 1A, B) particularly important for the polarization

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Figure 1. *Clitaetra thisbe* female from Gilimale Forest Reserve: dorsal/frontal view A/B; web C; hub detail D. Photos by SPB.

of nephilid characters. In this study, we describe the previously unknown male of *C. thisbe*, correct some errors of interpretation of the female genitalic structures and revise the phylogeny of *Clitaetra* by including the new and revised information. Part of the material of *C. thisbe* (Bodinagala Forest Reserve) was collected not far from its type locality in Sri Lanka, the city of Galle. The forests of Galle, although degraded, were not "disastrously affected by the 2004 tsunami" as claimed by Kuntner (2006). We also analyze multilocus sequence data for many of the studied species. The molecular data resulted from our own ongoing work on araneoid phylogeny (e.g., Álvarez-Padilla et al., 2009; these sequences are readily available in GenBank). The included nucleotide data provide additional lines of evidence and allow a more rigorous test of phylogenetic hypotheses.

Kuntner's (2006) classification recognized two subfamilies within Nephilidae: Clitaetrinae, containing the genus *Clitaetra*, and Nephilinae, containing the remaining three nephilid genera. Clitaetrinae was further split into three subgenra: *Indoetra*, *Clitaetra*, and *Afroetra*. Kuntner's (2006) classification of *Clitaetra* has been used recently as a case example of a new approach to classification (Kuntner and Agnarsson, 2006). It is thus relevant to provide some comments on the merits of this approach, and we do so in the Discussion section of this paper.

MATERIALS AND METHODS

Specimens were examined with a Leica MZ16A stereoscopic microscope with a camera lucida and Leica DMRM compound microscope with a drawing tube. Drawings were done with graphite pencils on acid-free cotton paper. Hairs and macrosetae are not depicted in the final drawings. The right male palp was illustrated (the only intact palp available), and scanned images were digitally transposed. The epigynum was treated with SIGMA Pancreatin LP 1750 enzyme complex (Álvarez-Padilla and Hormiga, 2008) to digest remaining tissues and transferred to methyl salicylate solution for examination and drawing.

All pencil drawings were scanned and further improved with the help of GIMP 2.4 and Adobe Photoshop CS2 programs. Digital images of the specimens were taken in alcohol media with a Nikon DXM1200F digital camera mounted on a Leica MZ16A stereoscopic microscope. The final plate's layout and editing was done with Adobe Illustrator CS2. Webs were dusted with cornstarch for observation and photo documentation.

Phylogenetics

Characters. The character matrix of this study is taken from Kuntner's revision of *Clitaetra* (Kuntner, 2006). After submission of this paper for publication, Kuntner and Agnarsson (2009) published a study on Indian Ocean *Clitaetra*, in which they revised some of the scorings of four web-building characters for three *Clitaetra* species. Their analysis of a matrix with the revised character scores did not change the *Clitaetra* cladistic topology reported in Kuntner (2006) and Kuntner et al. (2008). For most of the characters, we have scored the male morphology of *C. thisbe* in accordance with the original character definitions of Kuntner (2006). These characters are discussed elsewhere (Kuntner, 2006, and references therein). One discrepancy between our analyses and Kuntner's work comes from differences in the interpretation and coding of some male pedipalpal sclerites. Arguably the most controversial point in this respect is Kuntner's treatment of the sclerite in the male palp functioning as a conductor. He states that in nephilids this sclerite, for which he uses the term "embolic conductor," is a novel structure that is part of the embolic division and thus non-homologous to the araneoid conductor (Kuntner, 2005, 2006; Kuntner et al., 2008; Kuntner and Agnarsson, 2009). We disagree with this interpretation and our rationale has been discussed elsewhere

(Dimitrov and Hormiga, 2009; see also Álvarez-Padilla, 2007; Álvarez-Padilla et al., 2009). In the present analyses, the conductor of nephilids is treated as homologous to the araneoid conductor, and character definitions and scorings in the matrix for the conductor and the "embolic conductor" are revised accordingly: character 144 coding the presence or absence of "embolic conductor" is removed from the matrix and characters 145–151 refer now to the conductor instead of the "embolic conductor." One additional state has been added to character 148 (conductor curvature) to describe the spirally curved conductor in some tetragnathids—circularly curved, following the tegular margin. In addition, several errors in the original matrix were corrected. Kuntner (2006) coded *Nesticus* as lacking a conductor; however, a conductor is present in this genus (e.g., Agnarsson, 2004; Griswold et al., 1998; Huber, 1993), and accordingly, we have corrected the scoring for *Nesticus* to reflect it. Careful examination of the epigynum of *C. thisbe* suggests that the copulatory ducts open ventrally (Fig. 2E G) and not caudally as suggested by Kuntner (2006). Our interpretation is also supported by SEM observations (Fig. 5D). As a result, the structures in *C. thisbe* referred to as "copulatory ducts" by Kuntner (2006: fig. 25B, C) are actually the fertilization ducts and vice versa. The complete morphological matrix used in the analyses is given in Appendix 1.

In addition to the morphological characters, molecular data available in GenBank for many of the taxa were downloaded and used in the analyses. We have used sequences from three nuclear (28S, 18S, and H3) and three mitochondrial genes (12S, 16S, and COI). The accession numbers of the sequences used in the analyses are given in Appendix 2. Several terminals are "composed" of two species: *Argiope argentata* (Fabricius, 1775) is represented by *A. argentata* and *Argiope savignyi* Levi, 1968 (as in Álvarez-Padilla et al., 2009); *Clitaetra episinoides* Simon, 1889, by *C. episinoides* and *Clitaetra* sp. from South Africa (as in Álvarez-Padilla et al., 2009). Although such "chimaeras" are not desirable, the monophyly of neither *Argiope* nor *Clitaetra* has been questioned; therefore, any potential errors in phylogenetic inference caused by these composed terminals should be minimal.

Analyses. All data, morphological and molecular, were analyzed simultaneously under the parsimony criterion. Because positional homology in ribosomal genes is not a trivial problem due to the presence of insertion and deletions, we have investigated two different approaches to this problem. In the first case, we used the traditional "static homology approximation" where, before the phylogenetic analysis, the homologous gene fragments are aligned with a multiple sequence alignment algorithm. To generate the alignments, we have used the program MAFFT v6 and the L-INS-I method (Katoh et al., 2002, 2005). Aligned gene fragments were combined with the morphological data and were analyzed with TNT v1.1 (Goloboff et al., 2003). Data were analyzed under both equal and implied weights (Goloboff, 1993), either with 1,000 replications, keeping 10 trees per replication, or 500 replications, keeping 200 trees per replication. In both cases, gaps were treated as missing data. Trees were swapped by the TBR algorithm, and minimum length = 0 (the default in TNT) was used as a collapsing rule in all searches. Jackknife with 36% probability of character removal and bootstrap support values with 1,000 pseudoreplications were calculated in TNT for the static alignments. For the analyses under implied weights, we have sampled different *k* values within a wide range of variation allowed by TNT 1.1. Values from 1 to 100 were sampled; with denser sampling in the lower range (1–20) until topology converged to the one from equal weights (see also Dimitrov and Hormiga, 2009).

One alternative approach to the problem of positional homology is direct optimization (Wheeler, 1996). Parsimony analyses

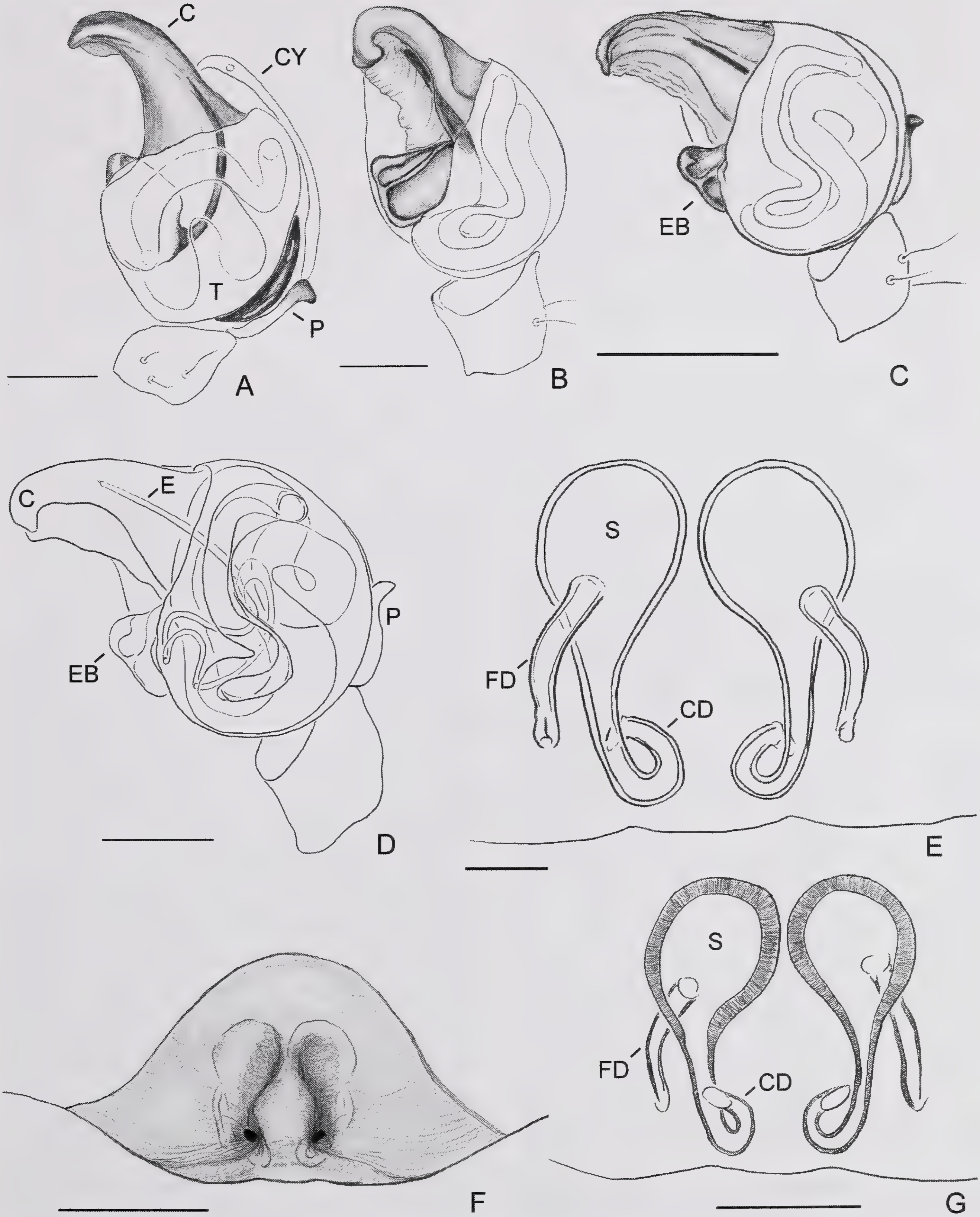

Figure 2. *Clitaetra thisbe* male: A, palp retrolateral; B, palp prolateral; C, palp ventral; D, palp schematic. *Clitaetra thisbe* female: E, vulva dorsal; F, epigynum ventral; G, schematic drawing of the female genitalia. Note the broken embolus. *Scale lines:* A, B, D, E, G 0.1 mm; C, F 0.2 mm.

under direct optimization were performed with the computer program POY 4 (Varón et al., 2008). POY allows different weighting schemes to be set for nucleotide substitutions and insertion/deletions. To test the sensitivity of the results to different weighting schemes, several different weighting combinations were investigated.

For the direct optimization analysis, jackknife values were calculated in POY 4. Analyses under direct optimization were run on the Biocluster at the University of Copenhagen (Copenhagen, Denmark).

More thorough phylogenetic analyses, including Bayesian inference and sensitivity analyses, on the basis of a very similar data set but with larger taxon sampling, have been recently published elsewhere (Álvarez-Padilla et al., 2009). Comparable analyses for the present data are beyond the scope of this paper.

ABBREVIATIONS USED IN TEXT AND FIGURES

ALE	anterior lateral eyes
AME	anterior median eyes
C	conductor
CD	copulatory ducts
CO	copulatory openings
CY	cymbium
E	embolus
EB	embolus base
FD	fertilization ducts
MNHN	Muséum national d'histoire naturelle, Paris, France
MPT	most parsimonious tree/s
P	paracymbium
PLE	posterior lateral eyes
PME	posterior median eyes
S	spermathecae
ST	subtegulum

RESULTS FROM CLADISTIC ANALYSES

We only present the trees from the analyses with TNT under equal weights because they are practically identical to the results from POY and to most of the results under implied weights. Differences in results between different analytical criteria are discussed in the text. Tree search under equal weights in TNT resulted in four MPT (L = 6,600, RI = 0.588, CI = 0.438). The strict consensus of these four trees (L = 6,658, RI = 0.583, CI = 0.426) is shown in Figure 6. Nephilids are found to be monophyletic, and, as in previous analyses, *Clitaetra* is the most basal member of Nephilidae (sister to a clade with the remaining nephilid genera). *Nephilengys* is the sister group of *Herennia*, and the clade composed by these two genera is the sister lineage of *Nephila*. *Epeirotypus* (Theridiosomatidae) appears as sister group to Nephilidae but this placement does not receive bootstrap or jackknife support. Relationships of families within Araneoidea are mainly unresolved, resulting in a large polytomy. Within *Clitaetra*, *C. thisbe* is the most basal species (sister to a clade with the remaining species in the genus), whereas relationships between the rest of the species mirror the results of Kuntner (2006), with *C. episinoides* being either the sister species of *Clitaetra perroti* or sister to a clade that includes *Clitaetra irenae*, *Clitaetra clathrata* and *Clitaetra simoni*.

Low values of k weight against homoplasious characters very strongly, and its use is discouraged (Goloboff, 1993, 1995), especially when analyzing molecular characters in which homoplasy is rampant. Results from analyses of the static alignment, together with the morphological data under implied weighting, recover the exact same topology for the relationships of nephilids, except for the arrangement of species within *Nephila* even with very low k values (1–3). None of the alternative topologies of *Nephila* interspecific relationships receives robust support. Independently of the value of k, relationships within *Clitaetra* were found to be the same as in the preferred tree of Kuntner (Kuntner, 2006: fig. 27B), where *C. perroti* is sister to *C. episinoides*.

Analyses under direct optimization in POY converge to the same topology for nephilid relationships as the results from TNT with statically aligned sequences. The only difference is that under some cost

combinations (1, 1 gap opening 1; and 2, 1 gap opening 1), *Nephila* was not recovered as monophyletic. This is most likely an artifact from the high proportion of missing data in the molecular partition for this genus. The relationships of araneoid families change with different cost combinations, and in some cases, tetragnathids are again the closest relatives to nephilids (when costs are set to 1, 2 and gap opening 1); however, none of these topologies receives jackknife support over 50.

DISCUSSION

Our results corroborate the monophyly of Nephilidae and their placement outside Tetragnathidae. However, the closest relatives of nephilids within Araneoidea and relationships of araneoid families remain to be satisfactorily resolved, but this is a problem that is beyond the scope of this paper. One possible explanation might be the limited taxonomic sampling of nonnephilid araneoid families in our study, which is certainly not designed to answer this question. Our results also confirm that *Deliochus* and *Phonognatha* belong to Araneidae, as already suggested by other authors (Álvarez et al., 2009; Kuntner et al., 2008), thus leaving in Nephilidae the genera *Clitaetra*, *Nephila*, *Herennia*, and *Nephilengys*. The monophyly of *Clitaetra* is well supported, and this genus is the sister group to a lineage with the remaining nephilid taxa, as first suggested by Hormiga et al. (1995). Relationships within *Clitaetra* are the same as in the results of Kuntner (2006), with *C. thisbe* being the most basal species in this lineage. Analyses under implied weighting corroborated the monophyly of *C. episinoides* + *C. perroti,* as suggested by Kuntner (2006), and this topology was selected as our preferred hypothesis for *Clitaetra* relationships (Fig. 7). The main difference between our results and the results of Kuntner (2006) and Kuntner et al. (2008) resides in the placement of *Nephila*. Here the closest relative of *Nephila* is not *Nephilengys* but the clade *Nephilengys* + *Herennia* as proposed by other studies (Álvarez-Padilla et al., 2009; Dimitrov and Hormiga, 2009; Hormiga et al., 1995). The analyses here add molecular data to the nephilid taxon sample of Kuntner (2006) to investigate the internal nephilid relationships. All analyses that we performed recover ((*Nephilengys* + *Herennia*) *Nephila*), and the clade *Nephilengys* + *Herennia* was always well supported. This topology is particularly relevant for character optimizations because numerous ethological and evolutionary studies use *Nephila* species as model organisms (e.g., Higgins, 2002; Robinson and Robinson 1973; Schneider and Elgar, 2002; and many more). For example, the widely discussed behavior of bulbus detachment (eunuch behavior) was previously thought to be secondarily lost in *Nephila* (Kuntner et al., 2008, 2009). Our results show that under parsimony, bulbus detachment is actually a synapomorphy of the clade *Herennia* + *Nephilengys*, with a single appearance in this group and thus primitively absent (not lost) in the *Nephila* clade (see Fig. 7, character 190; see also Álvarez-Padilla et al., 2009).

As we have mentioned above, Kuntner (2006) recognized two subfamilies within Nephilidae: Clitaetrinae (containing *Clitaetra*) and Nephilinae (containing the remaining three nephilid genera). However, Kuntner's (2006) proposal to subdivide the family Nephilidae into two subfamilies seems not only poorly justified but also contrary to the "advice" that he dispenses when he urges systematists to abandon the use of the subfamilies and subgenera, among other ranks (Kuntner and Agnarsson, 2006). "Clitaetrinae" and "Nephilinae" are indeed monophyletic groups, but what is to be gained from formally establishing subfamilial ranks, particularly when the content of "Clitaetrinae" is identical to that of *Clitaetra*? Furthermore, Kuntner (2006) also subdivided the genus *Clitaetra* into three subgenera on the basis of the monophyletic groups of his preferred phylogenetic hypothesis (as he notes, the subgenus *Indoetra* is actually composed of a single

species). While acknowledging that the Linnaean system does not require assigning formal ranks to all clades, Kuntner (2006: 52) nevertheless justifies "formal lineage names" for species groups in *Clitaetra* for the purpose of biogeographical discussions. How the use of a formal label, such as "subgenus *Afroetra,*" as opposed to the informal name "clade Afroetra," improves communication or facilitates discussion is a mystery to us. Kuntner (2006) based his classification on a purported "compromise approach" between traditional Linnaean nomenclature (ICZN, 1999) and the so-called "phylogenetic nomenclature" (Cantino and de Queiroz, 2007). Such a "nomenclatural system" was discussed in more detail in a separate contribution (Kuntner and Agnarsson, 2006), in which the classification of *Clitaetra* is used as a showcase example of the authors' "recommendations for the future of biological classification." Interestingly, their paper starts with a significant factual error: Contrary to their claims, binomial nomenclature did not start with Clerck's *Aranei Svecici* and the 10th edition of Linnaeus' *Systema Naturae*. Some readers of Kuntner and Agnarsson (2006), ourselves included, might very well have expected that a scholarly work that essentially aims to review and advise on how to produce biological classifications from cladograms would have extensively cited the large body of previous research that addressed this issue. Such works span no less than two decades after the publication of *Phylogenetic Systematics* (Hennig, 1966), and, incidentally, many of them appeared in the pages of the same journal in which Kuntner and Agnarsson (2006) discussed their singular method (in those days, published under the name *Systematic Zoology*). We find the omission of so many relevant works (e.g., Eldredge and Cracraft, 1980; Farris, 1976; Hennig, 1975; Nelson, 1972, 1974; Wiley, 1979, 1981) simply appalling. In fact, given how their paper is written and what relevant works they decided to cite, we would be hardly surprised if a naïve reader concluded that explicitly phylogenetic classifications did not start until the proponents of "phylogenetic taxonomy" began to publish their views. Of course, such a conclusion would be simply preposterous. As Farris (1976) had succinctly summarized, a phylogenetic classification "requires only that each monophyletic group be a taxon, each taxon be a monophyletic group, and the natural inclusion relations of monophyletic groups be retained by the taxa." This statement, more than three decades old, is anything but a novel proposition nowadays. We do not aim to discuss in depth Kuntner and Agnarsson's (2006) approach; however, we fail to see how it is superior to the explicitly phylogenetic Linnaean classifications currently used by many practicing taxonomists. Except for the dismissal of some of what they call "intermediate ranks" and of type taxa, Kuntner and Agnarsson's proposal is anything but new, as taxonomists have been building Linnaean phylogenetic classifications with explicitly monophyletic and empirically supported higher taxa for more than three decades. Their own example (Kuntner and Agnarsson, 2006: 778, fig. 1) does illustrate that, in practice, their "combination approach" does not differ significantly from a cladistic Linnean classification, except for the use of the label "clade" instead of "subgenus." We do have to agree with Kuntner and Agnarsson's (2006: 781) assessment that "their" own requirement that "superspecific names represent monophyletic groups" is, more than half a century after the publication of Hennig's *Grundzüge einer Theorie der Phylogenetischen Systematik*, trivial. That the codes (e.g., the ICZN) do not include the word "monophyly" and "synapomorphy" (Kuntner and Agnarsson, 2006: 781) is simply a moot point to those who understand the underlying principles upon which the codes are based, because nomenclature does not aim to determine the inclusiveness or exclusiveness of any taxon. Kuntner's (2006) implementation of Kuntner and Agnarsson's (2006) nomenclatural approach is probably the most signif-

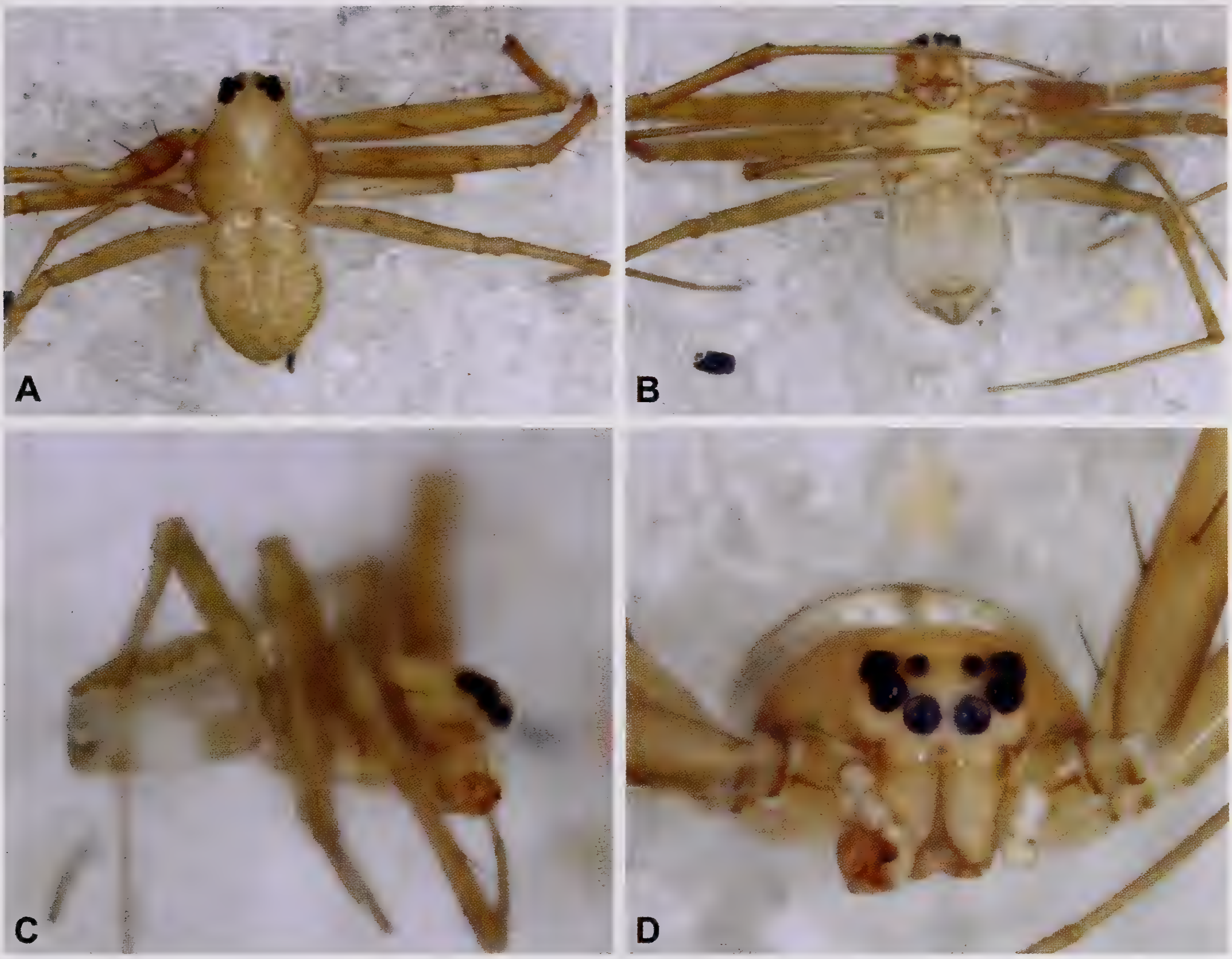
Figure 3. *Clitaetra thisbe* male: A, dorsal; B, ventral; C, lateral; D, frontal.

icant confirmation that it does not offer any substantial changes, other than terminological, to the existing cladistic implementations of the Linnaean system. After a lengthy discussion about the advantages of a rankless system, as proposed by the "Phylocode," Kuntner adopts a system for the classification of *Clitaetra* that has three subgenera and two subfamilies for Nephilidae! Furthermore, the proposed subgenus *Indoetra* contains just one species—thus, it might not be monophyletic (Platnick, 1976, 1977)—contradicting the requirement for monophyly of higher taxa.

TAXONOMY

Family Nephilidae Simon, 1894
Genus *Clitaetra* Simon, 1889

Clitaetra thisbe Simon, 1903
Figures 1–5

Type: Female holotype from Sri Lanka in MNHN, not examined.

C. thisbe Simon, 1903: 24.

C. thisbe Kuntner, 2006: 51, figs. 25A–C.

Diagnosis. As noted by Kuntner (2006), *C. thisbe* is much smaller than other congeners and has spermathecae, fertilization, and copulatory ducts that are easily observed through the abdominal cuticle. In Kuntner's (2006) diagnosis, the female genital morphology is misinterpreted and the copulatory openings are described as being posteriorly oriented (they are actually ventrally oriented; see Figs. 2E–G, 5D). The size and shape of the conductor is

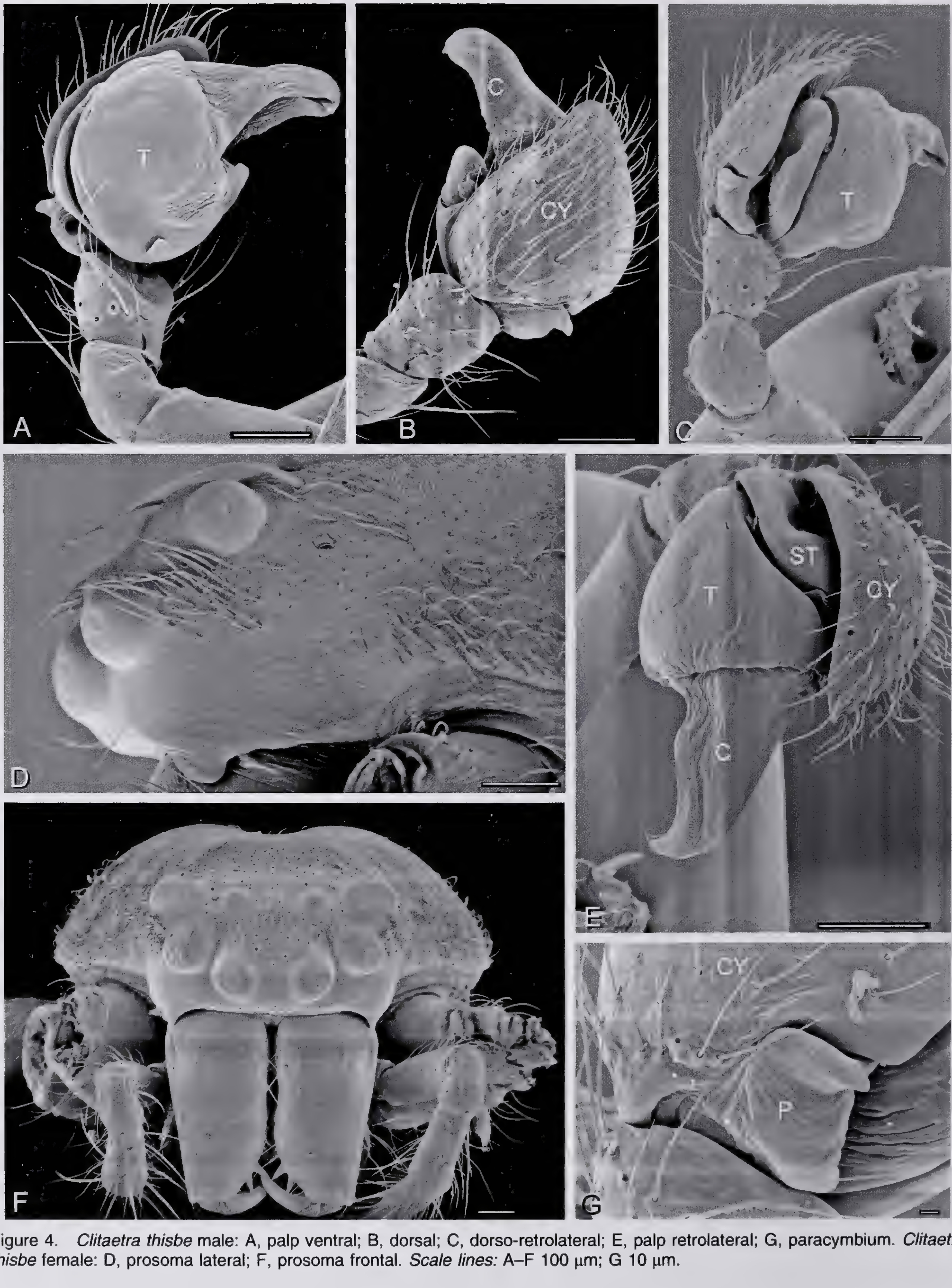

Figure 4. *Clitaetra thisbe* male: A, palp ventral; B, dorsal; C, dorso-retrolateral; E, palp retrolateral; G, paracymbium. *Clitaetra thisbe* female: D, prosoma lateral; F, prosoma frontal. *Scale lines:* A–F 100 μm; G 10 μm.

Figure 5. *Clitaetra thisbe* female: A, prosoma dorsal; B, prosoma ventral; C, spinnerets; D, epigynum; E, PMS; F, PLS; G, ALS; H, tarsus leg IV, arrow points to sustentaculum. *Scale lines:* A–C 100 μm; D–H 10 μm.

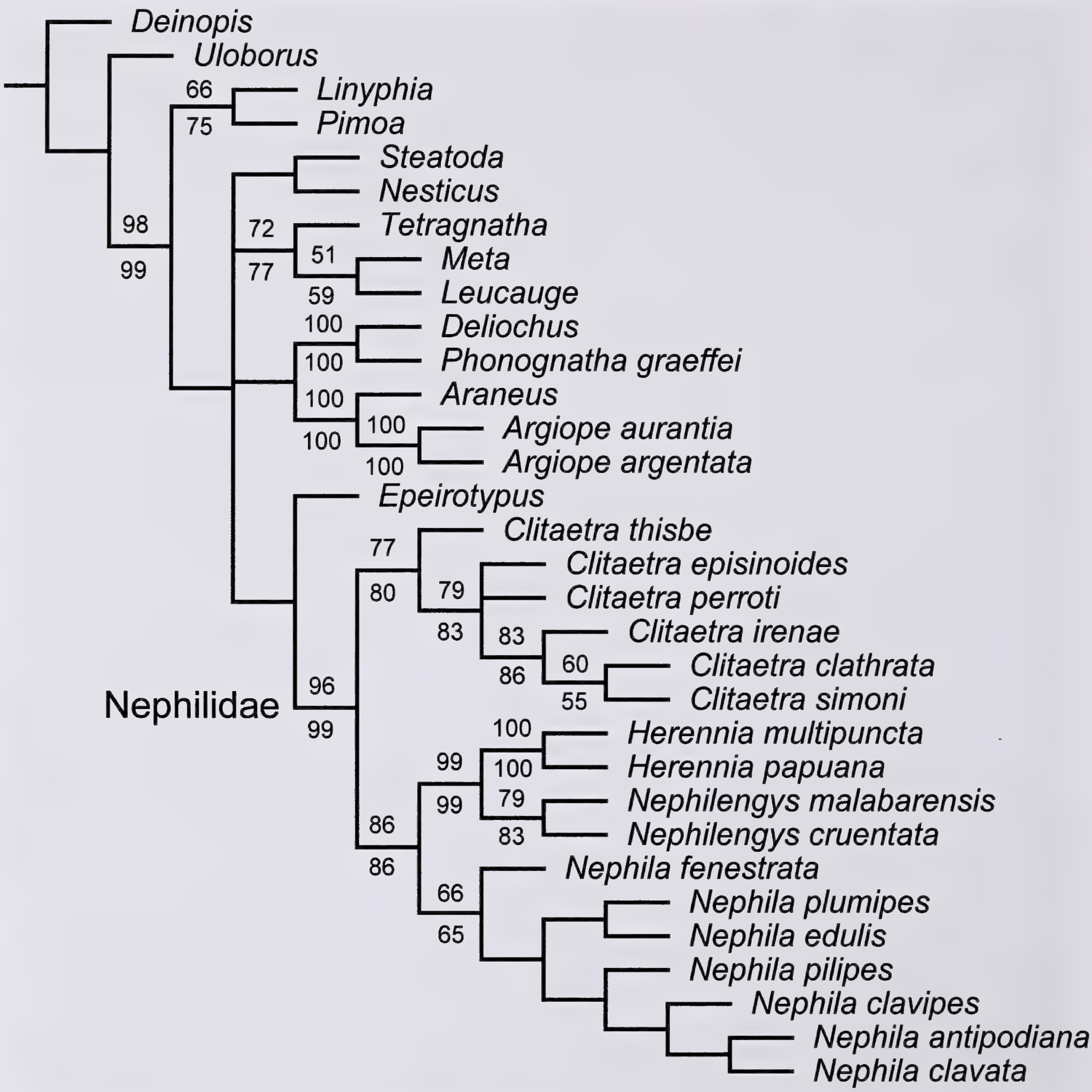

Figure 6. Consensus of four MPT found under equal weights analyzing statically aligned sequences and morphological data. Values above branches represent bootstrap support; values below branches represent jackknife support (bootstrap and jackknife values <50 are not indicated in the figure).

unique to the males of this species, being much wider and straighter than in the other species of *Clitaetra* (Figs. 2A–C, 4A, B, E).

Description (male). Small spiders with fairly long legs relative to body size. Total body length 2.57, prosoma 1.24 long, 1.06 wide, 0.69 high; abdomen 1.33 long, 1.05 wide, 0.75 high. Prosoma light brown–yellowish with darker pigmentation surrounding eyes (Fig. 3A, D). Sternum yellowish, 0.59 wide, 0.65 long. Labium triangular, distally with wide rectangular base. Eyes in two recurved rows, PME smaller than other eyes; all other eyes of similar size relatively close together, separated by less than 1 AME/PLE diameter, except for distance between PME, which is more than 1 PME diameter. Clypeus low; clypeus height 0.1, 0.3 times 1 AME diameter. Chelicerae yellowish. Abdomen

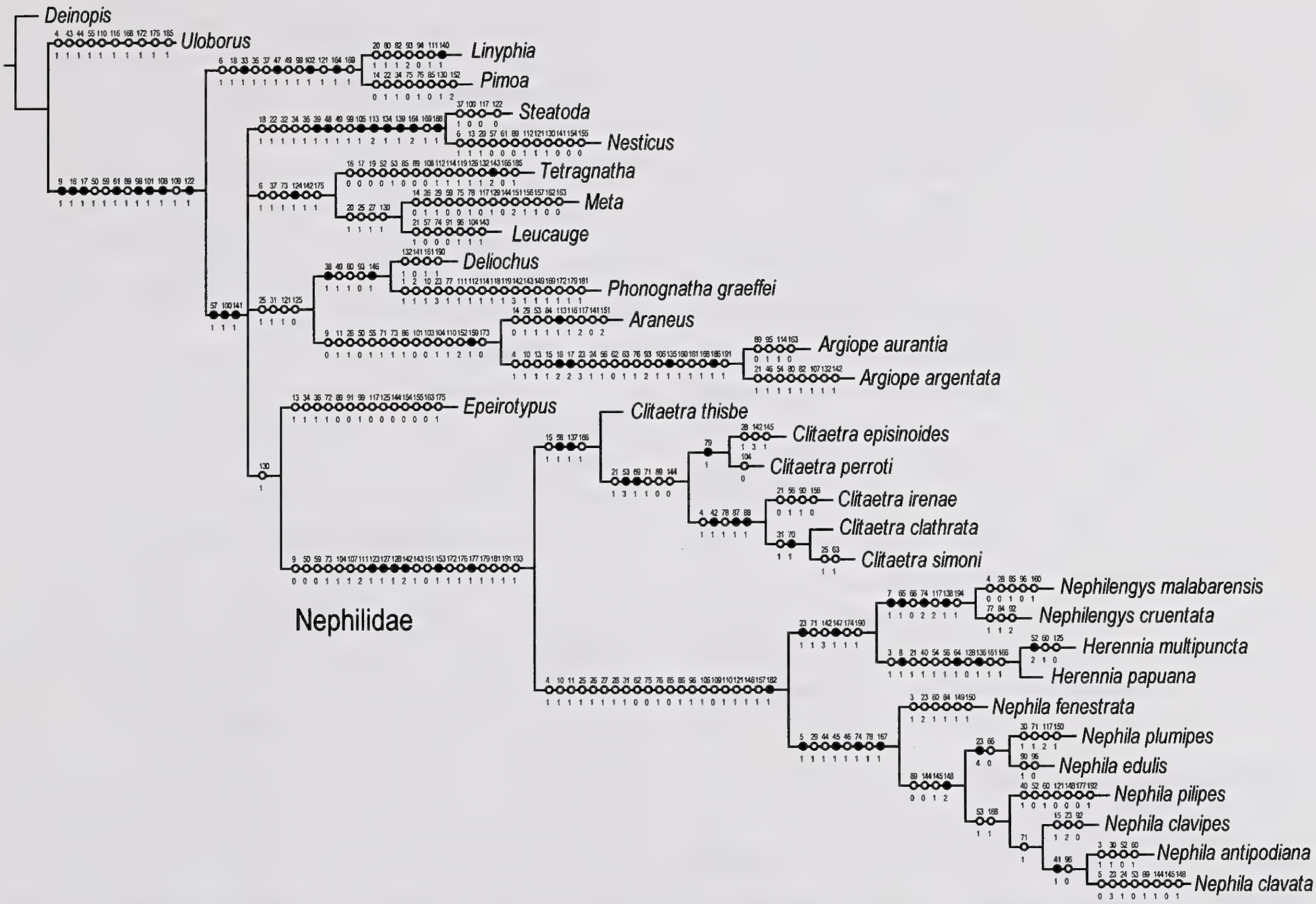

Figure 7. Character optimization on one of the four MPT under equal weights analyzing statically aligned sequences and morphological data representing the working hypothesis of *Clitaetra* relationships. Black circles represent unique gains; white circles represent homoplasic gains or reversals. Numbers above and below the circles indicate the character number and its state, respectively. Only the unambiguous character changes are mapped.

with slightly darker dorsal scutum and numerous white dots (Fig. 3A); ventral color light with white dots around spinnerets (despite high degree of discoloration of specimens, darker transverse band just anterior to spinnerets is observable). Legs darker than prosoma, brownish, with darker spines. Palp (Figs. 2A–D, 4A–C, E, G) with rounded tegulum and relatively short but very robust fingerlike conductor.

Description (female). A very detailed description of the female holotype was provided by Kuntner (2006). Here, we simply correct his interpretation of the epigynal morphology on the basis of our observations, including SEM images. The ducts labeled fertilization ducts by Kuntner (2006) are in fact the copulatory ducts, and they open ventrally on the epigynum (Figs. 2E–G, 5D). The other pair of ducts, copulatory ducts *sensu* Kuntner, are in fact the fertilization ducts.

Distribution. Endemic to Sri Lanka. *Clitaetra thisbe* is also the only species of the genus found outside Africa and adjacent Islands.

Natural History. These spiders build their dual-ladder webs on tree trunks. All observed webs were nearly vertical, around three times longer than wide, and with nearly parallel vertical sides (Fig. 1C). Webs were never built during the day. The central one-third of the web is a perfect orb (Fig. 1C, D); the dual ladders (the remaining two-thirds of the web) extend upward and downward, respectively. The hub of the orb was not visibly reinforced or modified with silk. All radii at their origination points are equally spaced (Fig. 1C, D); the web includes many secondary and tertiary split

radii. Spiders rest at the hub during the day (Fig. 1A, B). It appears that these spiders do not digest used silk and instead roll it up and attach it to radii. A detailed account of the behavior will be published separately.

Material Examined. SRI LANKA: Sabaragamuwa Province: Ratnapura district: Gilimale Forest Reserve, 11-II-2007, hand collecting, Suresh Benjamin & Ziyard Jaleel, 1 male, 1 female, and 2 juveniles. Kegalle district: Kitulgala, degraded lowland rainforest, 14-II-2007, hand collecting, Ziyard Jaleel, 1 male and 2 females. Western Province: Kalutara District: Ingiriya, Bodinagala Forest Reserve, 10-II-2007, hand collecting, Suresh Benjamin & Ziyard Jaleel, 1 male, 1 female, and 1 juvenile. All the specimens are deposited in the Muséum d'histoire naturelle (Genève, Switzerland).

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Appendix 1.
Morphological matrix.

Taxon	Character																																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Deinopis	0	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	—	0	0	0
Uloborus	0	0	0	1	0	0	0	0	0	0	2	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	—	0	0	0
Araneus	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	0	1	0	0	0	0	0	1	1	1	0	1	0	1	0	0
Argiope aurantia	0	0	0	1	0	0	0	0	0	1	1	0	1	1	1	2	2	0	1	0	0	0	3	1	1	1	1	0	0	—	1	0	0
Argiope argentata	0	0	0	1	0	0	0	0	0	1	1	0	1	1	1	2	2	0	1	0	1	0	3	1	1	1	1	0	0	—	1	0	0
Linyphia	0	0	0	0	0	1	0	0	1	0	2	0	0	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	—	0	0	1
Pimoa	0	0	0	0	0	1	0	0	1	0	2	0	0	0	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	—	0	0	1
Steatoda	0	0	0	0	0	0	0	0	1	0	2	0	0	1	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	—	0	1	0
Nesticus	0	0	0	0	0	1	0	0	1	0	2	0	1	1	0	1	1	1	1	1	0	1	0	0	0	0	0	0	0	—	0	1	0
Epeirotypus	1	0	0	0	0	0	0	0	1	0	2	0	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	—	0	0	0
Tetragnatha	0	0	0	0	0	1	0	0	1	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	—	0	1	0
Meta	0	0	0	0	0	1	0	0	1	0	2	0	0	0	0	1	1	0	1	1	0	0	0	0	1	1	1	0	1	0	0	1	0
Leucauge	0	0	0	0	0	1	0	0	1	0	2	0	0	1	0	1	1	0	1	1	1	0	0	0	1	0	1	0	0	—	0	0	0
Deliochus	0	0	0	0	0	0	0	0	1	0	2	1	0	1	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	—	1	0	0
Phonognatha graeffei	1	1	0	0	0	0	0	0	1	1	2	1	0	1	0	1	1	0	1	0	0	0	3	0	1	0	1	0	0	—	1	0	0
Clitaetra episinoides	0	0	0	0	0	0	0	0	0	0	2	0	0	1	1	0	0	0	1	0	1	0	3	1	0	0	0	1	0	—	0	0	0
Clitaetra perroti	0	0	0	0	0	0	0	0	0	0	2	0	0	1	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	—	0	0	0
Clitaetra clathrata	0	0	0	1	0	0	0	0	0	0	2	0	0	1	1	0	0	0	1	0	1	0	3	1	0	0	0	0	0	—	1	0	0
Clitaetra irenae	0	0	0	1	0	0	0	0	0	0	2	0	0	1	1	0	0	0	1	0	0	0	3	1	0	0	0	0	0	—	0	0	0
Clitaetra simoni	0	0	0	1	0	0	0	0	?	0	2	0	0	1	1	0	0	0	1	0	1	0	3	1	1	0	0	0	0	—	1	0	0
Clitaetra thisbe	0	0	0	0	0	0	0	0	0	0	2	0	0	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	—	0	0	0
Nephila clavipes	1	1	0/1	0	0/1	0	0	0	0	1	1	1	0	1	1	1	1	0	1	0	0	0	2	0	1	1	1	0	1	0	1	0	0
Nephila fenestrata	1	1	1	1	1	0	0	0	0	1	1	1	0	1	0	1	1	0	1	0	0	0	2	0	1	1	1	1	1	0	1	0	0
Nephila pilipes	1	1	0	0	0/1	0	0	0	0	1	1	1	0	1	0	1	1	0	1	0	0	0	0	0	1	1	1	0	1	0	1	0	0
Nephila antipodiana	1	1	1	1	1	0	0	0	0	1	1	1	0	1	0	1	1	0	1	0	0	0	0/4	0	1	1	1	1	1	1	1	0	0
Nephila clavata	1	1	0	1	0	0	0	0	0	1	1	1	0	1	0	1	1	0	1	0	0	0	3	1	1	1	1	1	1	0	1	0	0
Nephila plumipes	1	1	0/1	1	0/1	0	0	0	0	1	1	1	0	1	0/1	1	1	0	1	0	0	0	4	0	1	1	1	1	1	1	1	0	0
Nephila edulis	1	1	0	1	1	0	0	0	0	1	1	1	0	1	0/1	1	1	0	1	0	0	0	4	0	1	1	1	1	1	0	1	0	0
Herennia multipuncta	0	0	1	1	0	0	0	1	0	1	1	0	0	1	0	0	0	0	1	0	1	0	1	1	1	1	1	1	0	—	1	0	0
Herennia papuana	0	0	1	1	0	0	0	1	0	1	1	0	0	1	0	0	0	0	1	0	1	0	1	1	1	1	1	1	0	—	1	0	0
Nephilengys malabarensis	1	1	0	0	0	0	1	0	0	1	1	1	0	1	0	0	0	0	1	0	0	0	1	1	1	1	1	0	0	—	1	0	0
Nephilengys cruentata	1	1	0	1	0	0	1	0	0	1	1	1	0	1	0	0	0	0	1	0	0	0	1	1	1	1	1	1	0	—	1	0	0

APPENDIX 1. CONTINUED.

Taxon	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66
Deinopis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0	—
Uloborus	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	—	0	0	0	1	0	0	0	—
Araneus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	1	—	1	1	0	0	0	—
Argiope aurantia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0/1	0	0	1	1	1	0	0	0	1	0	1	0	0	—
Argiope argentata	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	1	1	1	0	0	0	1	0	1	0	0	—
Linyphia	0	—	1	1	0	0	0	0	0	0	0	0	0	1	0	1	1	—	1	0	0	0	0	0	—	1	—	1	1	0	0	0	—
Pimoa	1	—	1	1	0	0	0	0	0	0	0	0	0	1	0	1	1	—	1	0	0	0	0	0	—	1	—	1	1	0	0	0	—
Steatoda	1	—	1	1	0	1	—	—	—	0	0	0	0	0	1	1	1	—	1	0	0	0	0	1	0	1	—	1	1	0	0	0	—
Nesticus	1	—	1	0	0	1	—	—	—	0	0	0	0	0	1	1	1	—	1	0	0	0	0	0	—	1	—	0	1	0	0	0	—
Epeirotypus	1	—	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	—	1	0	0	0	0	1	0	1	—	1	1	1	0	0	—
Tetragnatha	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	—	0	1	0	0	0	1	0	1	—	1	1	0	0	0	—
Meta	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	—	1	0	0	0	0	1	0	0	0	1	1	0	0	0	—
Leucauge	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	—	1	0	0	0	0	0	—	1	—	1	1	0	0	0	—
Deliochus	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	—	1	0	0	0	0	0/1	0	0/1	0	1	1	0	0	0	—
Phonognatha graeffei	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	—	1	0	0	0	0	1	0	0	0	1	1	0	0	0	—
Clitaetra episinoides	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	0	0	0	1	1	0	0	1	1	0	0	0	1
Clitaetra perroti	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	0	0	0	1	1	0	0	1	1	0	0	0	1
Clitaetra clathrata	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	—	1	3	0	0	0	1	1	0	0	1	1	0	0	0	1
Clitaetra irenae	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	3	0	0	1	1	1	0	0	1	1	0	0	0	1
Clitaetra simoni	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	?	?	1	3	0	0	0	1	1	0	0	1	1	1	0	0	1
Clitaetra thisbe	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	1	1	0	0	0	1
Nephila clavipes	0	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	1	1	0	0	0	1	0	0	0	1	0	1	0	0	1
Nephila fenestrata	0	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	0/1	0/1	0	0	0	1	0	0	1	1	0	1	0	0	1
Nephila pilipes	0	1	0	0	0	0	1	0	0	0	1	1	1	0	0	0	0	1	0	1	0	0	0	1	0	0	1	1	0	1	0	0	1
Nephila antipodiana	0	1	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0	1	0	1	0	0	0	1	0	0	1	1	0	1	0	0	1
Nephila clavata	0	1	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	1	0	0	1
Nephila plumipes	0	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	1	0	0	0	0	1	0	0	0/1	1	0	1	0	0	0
Nephila edulis	0	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	1	0	0	0
Herennia multipuncta	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	2	0	1	0	1	1	0	0	1	1	0	1	1	0	1
Herennia papuana	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	1	0	0	0	1	0	1	1	0	1
Nephilengys malabarensis	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	1	0	1	0
Nephilengys cruentata	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	1	0	1	0

Appendix 1. Continued.

Taxon	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
Deinopis	—	—	—	—	0	0	0	—	0	0	0	0	0	0	—	0	—	0	0	0	0	0	0	0	0	0	0	0	0	0	—	0	0
Uloborus	—	—	—	—	0	0	0	—	1	0	0	0	0	0	—	0	—	0	1	0	0	0	0	0	1	1	1	1	0	0	—	0	0
Araneus	—	—	—	—	1	0	1	4	0	0	0	0	0	0	—	0	—	1	1	1	0	0	1	—	1	?	1	1	?	1	0	1	0
Argiope aurantia	—	—	—	—	1	0	1	4	0	1	0	0	0	0	—	0	—	0	1	1	0	0	0	1	1	2	2	1	1	1	0	1	0
Argiope argentata	—	—	—	—	1	0	1	4	0	1	0	0	0	1	0	1	2	0	1	1	0	0	1	—	1	2	2	1	0	1	0	1	0
Linyphia	—	—	—	—	0	0	0	—	1	0	0	0	0	1	0	1	0	0	1	0	0	0	1	—	1	1	2	0	0	0	—	1	1
Pimoa	—	—	—	—	0	0	0	—	0	1	0	0	0	0	—	0	—	0	0	0	0	0	1	—	1	1	1	1	0	0	—	1	1
Steatoda	—	—	—	—	0	0	0	—	1	0	0	0	0	0	—	0	—	0	1	0	0	0	1	—	1	1	1	1	0	0	—	1	1
Nesticus	—	—	—	—	0	0	0	—	1	0	0	0	0	0	—	0	—	0	1	0	0	0	0	0	1	1	1	1	0	0	—	1	1
Epeirotypus	—	—	—	—	0	1	0	—	1	0	0	0	0	0	—	0	—	0	1	0	0	0	0	0	0	1	1	1	0	0	—	1	1
Tetragnatha	—	—	—	—	1	1	1	4	1	0	—	0	0	—	—	—	—	—	0	0	—	—	0	?	1	—	0	0	0	0	—	1	0
Meta	—	—	—	—	0	0	1	4	0	0	0	1	0	0	—	0	—	0	1	0	0	0	1	—	1	1	2	0	0	0	—	1	0
Leucauge	—	—	—	—	1	1	1	0	1	0	0	0	0	0	—	0	—	0	1	0	0	0	1	—	0	1	2	1	0	1	0	1	0
Deliochus	—	—	—	—	0	0	0	—	1	0	0	0	0	1	0	1	1	0	1	0	0	0	1	—	1	1	0	1	0	1	0	1	0
Phonognatha graeffei	—	—	—	—	0	0	0	—	0	0	1	0	0	1	0	0/1	0	0	1	0	0	0	1	—	1	2	0	1	0	0	—	1	0
Clitaetra episinoides	0	0	1	0	1	0	1	0	1	0	0	0	1	0	—	0	—	0	1	0	0	0	0	0	1	1	1	1	0	0	—	1	0
Clitaetra perroti	0	0	1	0	1	0	1	0	1	0	0	0	1	0	—	0	—	0	1	0	0	0	0	0	1	1	1	1	0	0	—	1	0
Clitaetra clathrata	0	0	1	1	1	0	1	0	0	0	0	1	0	0	—	0	—	0	1	0	1	1	0	0	1	1	1	1	0	0	—	1	0
Clitaetra irenae	0	0	1	0	1	0	1	0	0	0	0	1	0	0	—	0	—	0	1	0	1	1	0	1	1	1	1	1	0	0	—	1	0
Clitaetra simoni	0	0	1	1	1	0	1	0	1	0	0	1	0	0	—	0	—	0	1	0	1	1	0	0	1	?	?	?	?	0	—	1	0
Clitaetra thisbe	0	0	0	0	0	0	1	0	1	0	0	0	0	0	—	0	—	0	1	0	0	0	1	—	1	1	1	1	0	0	—	1	0
Nephila clavipes	0	1	0	0	1	0	1	3	0	1	0	1	0	0	—	0	—	0	0	1	0	0	0	0	0	0	1	1	0	1	0	1	0
Nephila fenestrata	0	1	0	0	0	0	1	1	0	1	0	1	0	1	0	1	1	1	0	1	0	0	1	—	1	1	1	1	1	1	1	1	0
Nephila pilipes	0	0	0	0	0	0	1	3	0	1	1	1	0	0	—	0	—	0	0	1	0	0	0	0	0	1	1	1	0	1	1	1	0
Nephila antipodiana	0	1	0	0	1	0	1	1	0	1	1	1	0	0	—	0	—	0	0	1	0	0	0	0	0	1	1	1	0	0	—	1	0
Nephila clavata	0	1	0	0	1	0	1	1	0	1	1	1	0	0	—	0	—	0	0	1	0	0	1	—	0	1	1	1	0	0	—	1	0
Nephila plumipes	—	—	—	—	1	0	1	0/1	0	1	0/1	1	0	0	—	0	—	0	0	1	0	0	0	0	1	1	1	1	0	1	1	1	0
Nephila edulis	—	—	—	—	0	0	1	1	0	1	0	1	0	0	—	0/1	1	0	0	1	0	0	0	1	0	1	1	1	0	0	—	1	0
Herennia multipuncta	1	0	0	0	1	0	1	0	0	1	0	0	0	1	1	1	0	0	0	1	0	0	1	—	1	1	2	1	1	1	1	1	0
Herennia papuana	1	0	0	0	1	0	1	0	0	1	0	0	0	1	1	1	0	0	0	1	0	0	1	—	1	?	?	?	?	1	1	1	0
Nephilengys malabarensis	—	—	—	—	1	0	1	2	0	1	0	0	0	1	0	1	1	0	1	1	0	0	1	—	1	1	1	1	1	0	—	1	0
Nephilengys cruentata	—	—	—	—	1	0	1	2	0	1	1	0	0	1	1	0	—	1	0	1	0	0	1	—	1	2	1	1	0	1	1	1	0

Appendix 1. Continued.

Taxon	Character 100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132
Deinopis	0	0	—	—	—	—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	—	—	—	—	—	—	0	0	—	0
Uloborus	0	0	0	0	—	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	1	0	0	—	—	—	—	—	—	0	0	—	0
Araneus	1	0	0	0	1	0	0	0	1	0	1	2	0	1	0	0	1	2	0	0	1	1	1	0	0	0	0	0	0	1	0	—	0
Argiope aurantia	1	0	0	0	1	0	1	0	1	1	1	0	0	0	1	0	0	1	0	0	1	1	1	0	0	0	0	0	0	1	0	—	0
Argiope argentata	1	0	0	0	1	0	1	1	1	0	1	2	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	1	0	—	1
Linyphia	0	1	1	1	0	0	0	0	1	1	0	1	0	0	0	0	0	1	0	0	1	1	1	—	3	1	0	0	0	0	0	—	0
Pimoa	0	1	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	1	1	0	4	1	0	0	0	0	1	0	0
Steatoda	0	1	0	1	0	1	0	0	1	1	0	0	0	2	0	0	0	0	0	0	1	0	0	—	—	—	—	—	—	0	0	—	0
Nesticus	1	1	0	1	0	1	0	0	1	1	0	0	1	2	0	0	0	1	0	0	1	1	1	0	3	1	1	0	0	0	1	0	0
Epeirotypus	1	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	?	0
Tetragnatha	1	1	0	1	0	0	0	0	0	1	0	0/1	1	0	1	1	0	1	1	1	1	0	1	—	1	1	1	0	0	0	0	—	1
Meta	1	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0	1	1	0	0
Leucauge	1	1	0	1	1	0	0	0	1	1	0	0	0	0	0	1	0	1	1	0	1	0	1	0	1	1	0	0	0	0	1	0	0
Deliochus	1	1	0	1	0	0	0/1	0	1	1	0	0	0	0	0	0	0	1	0	0	1	1	0/1	—	—	0	—	—	—	1	0	—	1
Phonognatha graeffei	1	1	0	1	0	0	0/1	0	1	1	0	1	1	0	1	0	0	1	1	1	1	1	1	0	5	0	0	0	0	0	0	—	0
Clitaetra episinoides	1	1	0	1	1	0	0	1	0	1	0	2	?	0	?	0	0	1	0	0	1	?	1	1	2	1	0	1	1	0	1	0	0
Clitaetra perroti	1	1	0	1	0	0	0	1	0	1	0	2	0	0	0	0	0	1	0	0	1	0	1	1	2	1	0	1	1	0	1	0	0
Clitaetra clathrata	1	1	0	1	1	0	0/1	1	0	1	0	2	?	0	?	0	0	1	0	0	1	?	1	1	2	1	0	1	1	0	1	0/1	0
Clitaetra irenae	1	1	0	1	1	0	0/1	1	0	1	0	2	?	0	?	0	0	1	0	0	1	?	1	1	2	1	0	1	1	0	1	0	0
Clitaetra simoni	1	1	0	1	1	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Clitaetra thisbe	1	1	0	1	1	0	0	1	0	1	0	2	?	0	?	0	0	1	0	0	1	0	1	1	2	1	0	1	1	0	1	?	0
Nephila clavipes	1	1	0	1	1	0	1	1	1	0	1	2	0	0	0	0	0	2	0	0	1	1	1	1	2	1	0	1	1	0	1	1	0
Nephila fenestrata	1	1	0	1	1	0	1	1	1	0	1	2	0	0	0	0	0	1	0	0	1	1	1	1	2	1	0	1	1	0	1	1	0
Nephila pilipes	1	1	0	1	1	0	1	1	1	0	1	2	0	0	0	0	0	1	0	0	1	0	1	1	2	1	0	1	1	0	1	1	0
Nephila antipodiana	1	1	0	1	1	0	1	1	1	0	1	2	0	0	0	0	0	0/1	0	0	1	1	1	1	2	1	0	1	1	0	1	1	0
Nephila clavata	1	1	0	1	1	0	1	1	1	0	1	2	0	0	0	0	0	2	0	0	1	1	1	1	2	1	0	1	1	0	1	1	0
Nephila plumipes	1	1	0	1	1	0	1	1	1	0	1	2	0	0	0	0	0	2	0	0	1	1	1	1	2	1	0	1	1	0	1	?	0
Nephila edulis	1	1	0	1	1	0	1	1	1	0	1	2	0	0	0	0	0	1	0	0	1	1	1	1	2	1	0	1	1	0	1	?	0
Herennia multipuncta	1	1	0	1	1	0	1	1	0	0	1	2	0	0	0	0	0	1	0	0	1	1	1	1	2	0	0	1	0	0	1	0	0
Herennia papuana	1	1	0	1	1	0	1	1	0	0	1	2	0	0	0	0	0	1	0	0	1	1	1	1	2	1	0	1	0	0	1	0	0
Nephilengys malabarensis	1	1	0	1	1	0	1	1	0	0	1	2	0	0	0	0	0	2	0	0	1	1	1	1	2	1	0	1	1	0	1	1	0
Nephilengys cruentata	1	1	0	1	1	0	1	1	0	0	1	2	0	0	0	0	0	2	0	0	1	1	1	1	2	1	0	1	1	0	1	1	0

APPENDIX 1. CONTINUED.

Taxon	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
	Character																																
Deinopis	0	—	—	0	0	0	0	0	0	0	0	0	—	0	?	?	?	?	0	0	0	0	0	0	0	0	0	0	0	0/1	0	0	0/1
Uloborus	1	0	0	0	0	0	0	0	0	0	0	1	—	0	0	?	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Araneus	1	0	0	0	0	0	0	0	0	0	0	1	—	0	0	0	0	0	2	2	0	1	1	0	0	1	1	0	0	1	1	0	1
Argiope aurantia	1	0	1	0	0	0	0	0	1	0	0	?	—	0	0	?	0	0	1	?	0	1	1	0	0	1	1	1	1	1	0	0	1
Argiope argentata	1	0	1	0	0	0	0	0	1	1	0	1	—	0	0	0	0	0	1	2	0	1	1	0	0	1	1	1	1	1	1	0	1
Linyphia	0	—	—	0	0	0	0	1	—	—	—	—	—	—	—	—	—	—	1	0	0	1	1	0	0	0	0	0	0	1	1	1	—
Pimoa	1	0	0	0	0	0	0	0	0	0	0	0	—	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	1	1	1	—
Steatoda	1	1	0	0	0	0	1	0	1	1	0	1	—	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	1	1	2	—
Nesticus	1	1	0	0	0	0	1	0	0	?	0	1	—	0	—	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	2	—
Epeirotypus	1	0	0	0	0	0	0	0	1	0	0	0	—	0	0	?	0	0	1	2	0	0	0	0	0	0	0	0	0	1	0	0	1
Tetragnatha	0	—	—	0	0	0	0	0	1	1	2	1	—	0	0	3	?	0	1	0	0	1	1	0	0	0	0	0	0	1	1	0	0
Meta	0	—	—	0	0	0	0	0	1	1	0	0	—	0	0	3	0	0	2	2	0	1	1	1	1	0	0	0	0	0	0	0	1
Leucauge	0	—	—	0	0	0	0	0	1	1	1	1	—	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	1	1	0	0/1
Deliochus	0	—	—	0	0	0	0	0	0	0	0	1	—	1	0	0	0	0	1	1	0	1	1	0	0	0	0	0	1	1	1	0	1
Phonognatha graeffei	0	—	—	0	0	0	0	0	1	3	1	1	—	1	0	0	1	0	1	0	0	1	1	0	0	1	0	0	0	1	1	0	1
Clitaetra episinoides	0	—	—	0	1	0	0	0	1	3	1	0	1	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	1	1	0	1
Clitaetra perroti	0	—	—	0	1	0	0	0	1	2	1	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	1	1	?	?
Clitaetra clathrata	0	—	—	0	1	0	0	0	1	2	1	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	1	1	0	?
Clitaetra irenae	0	—	—	0	1	0	0	0	1	2	1	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	1	?	0	1
Clitaetra simoni	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Clitaetra thisbe	0	—	—	0	1	0	0	0	1	2	1	1	0	0	0	0	0	0	0	1	1	1	1	?	0	0	0	0	0	1	?	0	1
Nephila clavipes	0	—	—	0	0	0	0	0	1	2	1	0	1	0	0	2	0	0	0	1	1	1	1	0	1	0	0	0	0	1	1	0	1
Nephila fenestrata	0	—	—	0	0	0	0	0	1	2	1	1	0	0	0	1	1	1	0	1	1	1	1	0	1	0	0	0	0	1	1	0	1
Nephila pilipes	0	—	—	0	0	0	0	0	1	2	1	0	1	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	1	1	0	1
Nephila antipodiana	0	—	—	0	0	0	0	0	1	2	1	0	1	0	0	2	0	0	0	1	1	1	1	0	1	0	0	0	0	1	1	0	1
Nephila clavata	0	—	—	0	0	0	0	0	1	2	1	1	0	0	0	1	0	0	0	1	1	1	1	0	1	0	0	0	0	1	1	0	?
Nephila plumipes	0	—	—	0	0	0	0	0	1	2	1	0	1	0	0	2	0	1	0	1	1	1	1	0	1	0	0	0	0	1	1	0	1
Nephila edulis	0	—	—	0	0	0	0	0	1	2	1	0	1	0	0	2	0	0	0	1	1	1	1	0	1	0	0	0	0	1	1	0	1
Herennia multipuncta	0	—	—	1	0	0	0	0	1	3	1	1	—	0	1	1	0	0	0	1	1	1	1	0	1	0	0	0	1	1	?	0	1
Herennia papuana	0	—	—	1	0	0	0	0	1	3	1	1	—	0	1	1	0	0	0	1	1	1	1	0	1	0	0	0	1	1	0	0	1
Nephilengys malabarensis	0	—	—	0	0	1	0	0	1	3	1	1	—	0	1	1	0	0	0	1	1	1	1	0	1	0	0	1	0	1	1	0	1
Nephilengys cruentata	0	—	—	0	0	1	0	0	1	3	1	1	—	0	1	1	0	0	0	1	1	1	1	0	1	0	0	0	0	1	0	0	1

Appendix 1. Continued.

Taxon	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195
Deinopis	0	0	0	0	0	0	0	—	—	—	0	0	0	0	0	0	—	—	0	0	0	0	—	—	0	0	0	0	0	—
Uloborus	0	0	1	0	0	0	1	—	0	0	1	0	1	0	0	0	—	0	0	1	0	0	—	?	0	0	0	1	0	—
Araneus	0	0	0	0	0	0	0	0	0	0	0	0	?	0	0	0	—	0	0	0	0	0	0	0	0	0	0	0	0	—
Argiope aurantia	0	0	1	0	0	0	0	0	0	0	0	0	?	?	0	0	—	0	0	0	1	0	0	0	0	1	?	0	0	—
Argiope argentata	0	0	1	0/1	0	0	0	0	0	0	0	0	1	0	0	0	—	?	0	0	1	0	0	0	0	1	1	0	0	—
Linyphia	—	0	0	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	0	1	—	?	0	0	—	1	0	—
Pimoa	—	0	0	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	0	1	—	?	0	?	—	1	0	—
Steatoda	—	0	0	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	0	0	1	?	0	0	—	0	0	—
Nesticus	—	0	0	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	0	0	1	0	0	0	—	0	0	—
Epeirotypus	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	—	1	1	0	0	1	—	?	0	0	0	0	0	—
Tetragnatha	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	—	1	1	1	0	1	—	1	0	0	0	0	0	—
Meta	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	—	1	1	0	0	0	0	0	0	0	0	0	0	—
Leucauge	0	0	0	0/1	0	0	0	1	0	1	0	0	0	0	0	0	—	1	1	0	0	0	0	1	0	0	0	0	0	—
Deliochus	0	0	0	0	0	2	0	1	0	0	?	?	1	0	0	0	—	?	0	0	0	1	—	?	1	0	0	0	1	1
Phonognatha graeffei	0	0	0	1	0	1	1	—	0	0	?	0	1	1	0	1	0	0	0	0	0	1	—	?	0	0	0	0	2	1
Clitaetra episinoides	?	0	0	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	0	?	?	?	?	0	?	?	?	0	—
Clitaetra perroti	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	0	?	?	?	?	?
Clitaetra clathrata	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	0	?	?	?	0	—
Clitaetra irenae	1	0	0	0	1	1	1	—	1	0	1	1	1	1	1	1	0	1	2	0	0	1	—	?	0	1	1	1	0	—
Clitaetra simoni	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Clitaetra thisbe	1	0	0	0	1	0	1	0	0	0	1	?	1	?	0/1	1	?	?	?	0	?	?	?	?	?	?	?	1	0	—
Nephila clavipes	0	1	1	1	0	1	1	—	0	0	1	1	1	1	0	1	1	0	2	0	0	1	—	0	0	1	0	1	0	—
Nephila fenestrata	0	1	0	1	0	1	1	—	0	0	?	?	1	1	0	1	1	?	2	0	0	1	—	0	0	1	0	?	0	—
Nephila pilipes	0	1	1	1	0	1	1	—	0	0	1	0	1	1	0	1	1	1	2	0	0	1	—	0	0	1	1	1	0	—
Nephila antipodiana	0	?	?	?	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	0	0	?	?	?	0	?	?	?	0	—
Nephila clavata	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Nephila plumipes	0	1	0	1	0	1	?	?	0	0	?	?	1	1	0	1	1	?	?	0	0	?	?	?	0	0	0	?	0	—
Nephila edulis	0	1	0	1	0	1	?	?	0	0	?	?	1	1	0	1	1	?	?	0	0	?	?	?	0	?	?	?	0	—
Herennia multipuncta	1	0	0	0	1	?	?	?	1	?	?	?	?	?	?	?	?	?	?	0	0	?	?	?	1	?	?	?	0	—
Herennia papuana	1	0	0	0	1	1	1	—	1	0	1	1	?	?	1	1	?	?	2	0	0	1	—	0	1	0	0	1	0	—
Nephilengys malabarensis	0	0	0	1	1	1	?	?	1	0	?	?	1	1	0	1	?	1	?	0	0	1	—	0	1	?	?	?	1	0
Nephilengys cruentata	0	0	0	1	1	1	1	—	1	0	1	1	1	1	0	1	1	1	2	0	0	1	—	0	1	1	0	1	1	0

APPENDIX 2.
GENE FRAGMENTS AND GENBANK SEQUENCE ACCESSION NUMBERS.

Species	12S	16S	COI	H3	18S	28S
Araneus marmoreus	EU003230	NA	EU003278	EU003312	EU003341, EU003341, EU003341	EU153158, EU003397, EU003397
Argiope aurantia	NA	DQ146832.1	DQ146862.1	NA	NA	DQ018858.1
Argiope savignyi	EU003231	NA	EU003279	NA	EU003388, EU003388	EU153159, EU003398, EU003398
Clitaetra sp.	NA	NA	EU003281	EU003315	NA	NA
Deinopis sp.	NA	EU003249	NA	NA	EU003382, EU003383, EU003383	EU153163, EU003403, EU003403
Deliochus sp.	EU003234	EU003259	EU003284	NA	EU003345, EU003345, EU003345	EU153164, EU003404, EU003404
Epeirotypus brevipes	NA	EU003273	EU003286	EU003318	EU003347, EU003347, EU003347	EU153166, EU003406
Herennia multipuncta	EU003236	EU003260	EU003288	EU003320	EU003384, EU003385, EU003386	EU003432, EU003433
Leucauge venusta	EU003238	EU003263	EU003290	EU003322	EU003350, EU003350, EU003350	EU153169, EU003409, EU003409
Linyphia triangularis	EU003239	AY078664.1	EU003292	AY078702.1	EU003390, EU003390	EU153170, EU003410, EU003410
Meta menardi	NA	EU003268	EU003295	EU003325	EU003353, EU003353, EU003353	EU153173, EU003413, EU003413
Nephila clavata	AY164671.1	NA	AY052586.1	NA	AY425721.1	
Nephila clavipes	NA	NA	EU003302	EU003333	EU003377, EU003378	EU003422, EU003422
Nephila pilipes	NA	EU003276	DQ779283.1	NA	NA	NA
Nephila antipodiana	NA	NA	AY052587.1	NA	NA	NA
Nesticus cellulanus	NA	NA	NA	NA	AF005447, AF005447, AF005447	NA
Nephilengys malabarensis	EU003244	NA	EU003303	EU003334	EU003392	EU003434, EU003434
Phonognatha graeffei	EU003245	EU003275	NA	NA	EU003379, EU003380, EU003381	EU153183, EU003426, EU003426
Pimoa sp. X131	NA	AY230940.1	AY231025.1	AY230985.1	AY230893.1	AY231072.1
Steatoda borealis	NA	NA	EU003307	NA	EU003393, EU003393	EU153184, EU003428, EU003428
Tetragnatha versicolor	EU003246	NA	EU003308	NA	EU003394	EU153185, EU003429, EU003429
Uloborus glomosus	EU003247	NA	EU003310	EU003340	EU003366, EU003366, EU003366	EU003437, EU003438, EU003439

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